DOCUMENT RESUME

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ABSTRACT

More than 100 outdoor education and field science projects are compiled in this teacher's resource book. Designed for use in grades K-9, the activities cover the areas of field taxonomy, laboratory taxonomy, autecology, synecology, adaptation, economic biology, conservation, museum methods, culturing, zoo keeping, gardening, and woodcraft. Each project designates the topic (community relationships, life forms, soils, water, air, fossils, or you in your environment), suggested grade level, locality, activity or problem, background needed, specific objective, anticipated outcomes (concepts), procedure, materials needed, and suggested evaluation. Supplemental activities in art, social studies, language arts, mathematics, and science are listed but not explained in detail together with a large booklist. Teacher responsibilities for preparing field trips and using facilities are also explained and program evaluation questions are suggested. (BI)

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Project ECO

Teacher Resource Guide

SE 016 495

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Teacher Resource Booklet

This booklet, as the name implies, should be used as a resource from which a teacher may get some basic ideas of projects that might be carried on in the field. It is not meant to give a complete description of possible topics and procedures but should be used as only a starting point to stimulate the teacher's thinking.

If one, or several, of the topics appeals to you, and you wish more information please contact the ECO staff or bring the question up at your orientation sessions.

OBJECTIVES OF FIELD SCIENCE IN CONNECTION WITH PROJECT ECO

The student will:

1. Learn to recognize the more common and conspicuous animals and plants of Iowa. (Field taxonomy).
2. Become acquainted with the methods of identifying unfamiliar organisms. (Laboratory taxonomy).
3. Observe how living things depend on their environment. (Autecology).
4. Study the types of biological communities in central Iowa. (Synecology).
5. Find out how organisms fit into specific habitats. (Adaptation).
6. Discover what animals and plants are of particular importance to man. (Economic biology).
7. Consider the problems that arise as a result of the interaction of the balance of nature and man's desire to modify natural phenomena. (Conservation).
8. Learn various methods of collecting and preserving organisms. (Museum methods).
9. Transplant organisms from natural conditions to laboratory settings and maintain them alive. (Culturing, zoo keeping, gardening).
10. Experience living in outdoor situations. (Woodcraft).

TEACHERS RESPONSIBILITY CONNECTED WITH PREPARING FOR ECO FIELD TRIPS:

1. Attend the orientation session to be held prior to each field trip.
2. Spend some time during the intervening period preparing the students for some of the activities planned for the field trip.
3. If the trip is to last all day, or over the noon hour, instruct the students to bring a sack lunch.
4. The field trip should be held, rain or shine so instruct the students to wear appropriate clothing. (ECO does have 30 rain ponchos).

STANDARD RULES FOR TEACHERS USING PROJECT ECO FACILITIES

The first and foremost concern of the administration and coordinator is:

1. For the safety, at all times of each child. Everything you say and do and every decision you make must be made with safety in mind.

2. No children will be left unsupervised at any time or allowed to roam on their own.

3. The teachers will try to keep a teacher-student relationship and still tend to their needs and problems.

4. It is suggested that you refrain from inviting friends to participate.

5. Your fullest cooperation and help in making this program a success is very important.

6. The teachers should have their classes ready to board the bus at the time agreed upon. (Not too early).

7. Have fun and enjoy yourself; this becomes infectious and helps the students adapt to the situation and enjoy themselves.

8. Remember this will be a new experience for all the children. Let's make their experience a good one.

SUGGESTIONS FOR EVALUATION OF OUTDOOR EDUCATION EXPERIENCES

1. Were the objectives for the day clearly planned, stated, and understood by all?

2. Was the group adequately prepared?
(a) clothing (b) equipment (c) reference materials (d) background information

3. How large was the group? (ratio of leader to the pupils)

4. Were the group objectives flexible enough to permit unplanned learning activities?

5. Were all of the children actively involved in the learning process? (Learning by doing)

6. Did they appear to be having fun at the same time they were learning?

7. Did they appear to be having a difficult time answering all the leader's questions? Did the leader provide too many answers to the children's questions?

8. Was the atmosphere of discovery, exploration and problem solving evident?

9. Did the group seem to understand the vocabulary and concepts presented?

10. Did the lesson appear to hold the children's interest?

11. Was the length of time adequate for each lesson taught?

12. Were the uses of many of the five senses utilized in the learning process?

13. Did the leader have adequate control and supervision in guiding the children's learning experiences?

14. Were necessary safety precautions observed when walking through the woods and fields?

15. Do you feel that these lessons taught in the out-of-doors were best learned there rather than in a classroom?

16. Were some of the learning experiences correlated with what was being studied in the classroom?

Evaluation of the program of Outdoor Education can only come as the teacher sees the children approach the problems and ideas with understanding and awareness. The teacher will be the best judge of whether the outdoor experience has enriched the individual child and his knowledge.

Southern Illinois University
Dr. Tom Rillo

Please refer to the above while evaluating your trip. Any other ideas or comments, pro or con will be appreciated.

Ken Frazier, Project Coordinator

AMES COMMUNITY SCHOOL DISTRICT
Lincoln Building
120 South Kellogg
AMES, IOWA 50010

David L. Moorhead
Superintendent

February 22, 1972

Dear Teacher,

We need your opinions, your criticisms and your suggestions about Project ECO. You have been a key part of this unique project, and so we want to know how the project is going, what we can do to improve it, and so forth. This is a mid-year look at the program in the belief that we can make adjustments for the 3rd field trip.

To get this information in a way which is as brief and easy for you as possible, we have prepared a series of questions which require only that you indicate the response of your choice. However, please feel free to make any comments as you go along, and especially consider the request for criticisms and suggestions at the end. Please take a few minutes now to respond to this questionnaire and return it in the envelope to your principal today.

Sincerely,

David Moorhead
David Moorhead
Superintendent

Luther Kiser
Luther Kiser
Director, Project ECO

DM:LK/dc

Attachment.

Teacher _____ Class _____ School _____

Please respond to the following questions by circling your response:

SD = Strongly Disagree
D = Disagree
D/A = Neither disagree or agree
A = Agree
SA = Strongly Agree

1. Project ECO is a worthwhile curriculum venture.	SD	D	D/A	A	SA
2. I approve of the field trip preparations (teacher-coordinator meeting).	SD	D	D/A	A	SA
3. I felt more sure of myself during the Second ECO field trip than during the first.	SD	D	D/A	A	SA
4. I feel there needs to be an inservice program regarding Project ECO.	SD	D	D/A	A	SA
5. I feel there is too much emphasis on science in Project ECO.	SD	D	D/A	A	SA
6. I feel the classes not now in Project ECO would like to be involved in it.	SD	D	D/A	A	SA
7. I would like to be involved in the ECO project next year.	SD	D	D/A	A	SA
8. I feel more adult supervision is needed on the field trips.	SD	D	D/A	A	SA
9. I felt I understood the unit objectives adequately before the field trip.	SD	D	D/A	A	SA
10. I feel the time in the field is too long for my students.	SD	D	D/A	A	SA
11. I believe most of my students enjoy the Project ECO activities.	SD	D	D/A	A	SA
12. I feel the field trips have been too structured for my students.	SD	D	D/A	A	SA
13. I favor a milk-cookie break for my students on the field trips.	SD	D	D/A	A	SA
14. I believe virtually all my students met with some success in the field activities.	SD	D	D/A	A	SA
15. I feel my students <u>enjoyed</u> the unstructured time on field trips.	SD	D	D/A	A	SA
16. I feel my students <u>benefited</u> from the unstructured time on field trips.	SD	D	D/A	A	SA
17. I believe there was an atmosphere of "discovery" or "exploration" or "problem solving" among my students on the field	SD	D	D/A	A	SA

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17. I believe there was an atmosphere of "discovery" or "exploration" or "problem solving" among my students on the field trips.	SD	D	D/A	A	SA
18. I feel the parents would support Project ECO if it were not federally funded.	SD	D	D/A	A	SA
19. I believe the parents of my students would prefer to have the trip postponed in the event of inclement or cold weather.	SD	D	D/A	A	SA
20. I feel the parents clearly understand and accept the need for "special" clothing on field trips.	SD	D	D/A	A	SA
21. I believe the ECO Newsletter should go to the parents of all students involved in Project ECO.	SD	D	D/A	A	SA
22. I believe the parents of my students have enough information about Project ECO.	SD	D	D/A	A	SA
23. I feel the parents of children not involved in ECO feel their children should be involved.	SD	D	D/A	A	SA

24. I feel the parents of children not involved in ECO hope their children will be involved next year.	SD	D	D/A	A	SA
25. I feel the parents of children not involved in ECO feel field trips close to the school are enough.	SD	D	D/A	A	SA
26. I feel the parents of children not involved in ECO think there should be no field trips -- only classroom work.	SD	D	D/A	A	SA

27. How much time did you spend preparing your students for each field trip? _____

_____

28. How did you prepare your students for each field trip? _____

_____

_____

29. How much class time did you use for discussion of ECO activities after each field trip?

_____

30. What curriculum areas do you think benefit by way of "carry-over" from ECO activities?

_____

31. How many ECO field trips do you think there should be each year for your class? _____

32. Were you able to relate much of the field trip activities to your other studies in the classroom? Very Little Somewhat To a Large Extent Almost Entirely

33. I think the noon lunch should be: _____ Sack lunch, each bring his own.

_____ Picnic lunch, class go together for hot dogs, etc.

34. If there is a milk-cookie break in mid-morning, who should provide food?

_____ Individual Student

_____ Each School or Class

_____ Project ECO

35. Estimate what percent of the parents of your students approve of Project ECO. _____%

36. How many parents of your students have expressed the desire to go along on the field trips? _____

37. How should communication with parents about Project ECO be improved?

27. How much time did you spend preparing your students for each field trip? _____

_____

28. How did you prepare your students for each field trip? _____

_____

_____

29. How much class time did you use for discussion of ECO activities after each field trip?

_____

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35. Estimate what percent of the parents of your students approve of Project ECO. _____%

36. How many parents of your students have expressed the desire to go along on the field trips? _____

37. How should communication with parents about Project ECO be improved?

Newsletter PTA Newspaper Radio Other _____

38. What do you like about Project ECO? _____

_____

_____

39. What don't you like about Project ECO? _____

_____

_____

40. What do you see as the main benefits of Project ECO? _____

_____

_____

41. How can Project ECO be improved?

Topic: Community Relationships Suggested Grade Level: 1 or 3 Locality: city park

Activity or problem: Investigations of holes in the ground.

Background needed: None

Specific ECO objective: While visiting a timber tract, students will investigate the complexity of the interrelationships of life in a forest.

Anticipated outcome: (concepts) Children should decide that earthworms, and other tunnel makers are useful in several ways.

Procedure: Take children to area where there are many small holes with small piles of soil around them. Children may identify these as earthworm tunnels. Children take small funnels and fill a tunnel with water, notice the amount of water used.

Pour water on another section of ground where there are no tunnels. Notice what happens to the water.

Have the children crush some of the earthworm deposits in their fingers and note how easily the soil broke up.

Materials needed: (Teacher's responsibility) Pencil, note book.

Materials needed: (ECO responsibility) Funnels and water containers.

Suggested evaluation: Evaluate small discussion groups.

Topic: Life Forms Suggested Grade Level: K-3 Locality: local parks

Activity or problem: Looking at tree leaf forms.

Background needed: Recognition of different shapes of leaves from trees.

Specific ECO objective: While visiting a timber tract students will investigate the complexity of life in a forest.

Anticipated outcome: (concepts) Students will see that leaves from trees have many shapes and sizes, but have many things in common.

Procedure: Hand out seven to ten leaf samples to each two children and have them classify into 2 groups of similar features.

Materials needed: (Teacher's responsibility) Pencil, note book.

Materials needed: (ECO responsibility) Leaves to be identified which are pressed and named. Conifers (evergreen) and Deciduous (broad leaf).

Suggested evaluation: Teacher observation and evaluation of value judgments made by students.

Topic: Life Forms Suggested Grade Level: 1-3 Locality: local parks

Activity or problem: Looking at tree leaf forms.

Background needed: Recognition of different shapes on leaves of trees.

Specific ECO objective: While visiting a timber tract, students will investigate the complexity of the interrelationships of life in a forest.

Anticipated outcome: (concepts) Students will see that leaves are either simple or compound and can be classified as such.

Procedure: Take students on a nature hike and point out simple and compound leaf patterns.

Materials needed: (Teacher's responsibility) Pencil, note book.

Materials needed: (ECO responsibility) Supply leaves to be identified which are pressed and named. Simple leaves and compound leaves.

Suggested evaluation: Place a number of simple and compound leaves in a pile and have students seperate them into two piles of similar leaf structures.

Topic: Life Forms Suggested Grade Level: 1-3 Locality: local parks

Activity or problem: Looking at tree leaf forms.

Background needed: Recognition of different shapes of leaves from trees.

Specific ECO objective: While visiting a timber tract, students will investigate the complexity of the interrelationships of life in a forest.

Anticpated outcome: (concepts) Students will see that simple leaves may be lobed or relatively smooth, and that all lobed leaves have common characteristics.

Procedure: Take students on a nature hike and point out simple leaf patterns, allowing children to make judgments as to either being lobed or not.

Materials needed: (Teacher's responsibility) Pencil, note book.

Materials needed: (ECO responsibility) Supply of simple leaves to be identified.

Suggested evaluation: Place a number of simple leaves, lobed and not lobed, in a pile and have the students separate into two piles.

Topic: Life Forms Suggested Grade Level: 1 Locality: parks

Acitvity or problem: Study of insect homes.

Background needed: Have some idea as to what an insect is.

Specific ECO objective: While visiting a timber tract, students will investigate the complexity of the interrelationships of life in a forest.

Anticipated outcome: Students will discover that insect homes have much the same function as their own homes.

Procedure: Explain to students the many different kinds of insect homes.

Insect galls
- slippery elm pouch gall
- goldenrod bunch gall
- oak apple gall
- hackberry leaf

Show students pictures of such galls and allow them time to collect from nature.

Students may return with many insect houses for further study.

Materials needed: (Teacher's responsibility) Pencil, note book.

Materials needed: (ECO responsibility) None.

Suggested evaluation: Can the student identify an insect gall?

Topic: Soils Suggested Grade Level: 1 and 3 Locality:

Activity or problem: Study of soils.

Background needed: None

Specific ECO objective: Students will investigate the earth's crust in order to determine the effects of former environments on various ecological relationships.

Anticipated outcome: (concepts) Students will begin to classify soils as to materials contained - color and texture.

Procedure: Dig up a trowel full of soil and check if you find any of the following: pebbles, sand, twigs, leaves, weeds, insects, worms, or grass.

Check your soil sample as to color as follows: tan, brown, red, black.

Check your soil sample to see if a magnet will pick up any of of the soil.

Roll a little ball in your hands. Add enough water to make it roll easily. Roll the ball into a snake. Does your snake hold together: well, fairly well, not at all.

Materials needed: (Teacher's responsibility) Pencil, note book.

Materials needed: (ECO responsibility) Trowels, magnets, hand lens.

Suggested evaluation: Students will be able to preform the suggested tests on many kinds of soil.

Topic: Soil Suggested Grade Level: 1 Locality: local city park

Activity or problem: Simple rock collection.

Background needed: None.

Specific ECO objective: Students will investigate the earth's crust in order to determine the effects of former environments on various ecological relationships.

Anticipated outcome: (concepts) Matter is characterized by properties by which it can be identified and classified. Students will become aware of other things in their environment besides just rocks. Students will realize there are many ways to sort things - all correct.

Procedure: Have students pick up stones that they especially like as they walk along a nature trail or stream bed. Upon returning have students sort them.

It would be well to divide students into groups of two for collection and sorting. Let students select their own method of sorting. Compare methods and ideas.

Materials needed: (Teacher's responsibility) Pencil, note book, collecting sack.

Materials needed: (ECO responsibility) None.

Suggested evaluation: Have students classify things they have never seen before.

Topic: Soils Suggested Grade Level: 1-2 Locality: city park

Activity or problem: Find out about soil.

Background needed: None.

Specific ECO objective: Students will investigate the earth's crust in order to determine the effects of former environments on various ecological relationships.

Anticipated outcome: (concepts) Environments differ. Matter is characterized by properties by which it can be identified and classified.

Procedure: Visit different places which contain different kinds of soil. Example - on a grassy lot - bare lot - island around a tree - on a hillside.

Determine how hard the soil is by touching soil with your finger. Would it be very hard - hard - soft?

Determine how hard the soil is by trying to push a pencil into the soil. Would it be very hard - hard - soft?

Determine how fast water soaks into different soils, by driving a juice can, with both ends removed, about 1" into the ground. Fill the can with water. Wait two minutes and determine how much water soaked into the soil.

Materials needed: (Teacher's responsibility) Pencil, note book, 1 small juice can per group of 2.

Materials needed: (ECO responsibility) None.

Suggested evaluation: By discussion, determine if the students relate soil hardness to absorption ability.

Topic: Life Forms Suggested Grade Level: all Locality: look under procedure

Activity or problem: Adaptations for winter survival.

Background needed: Start with the premise that all species survive the winter. This may be developed in a discussion prior to the field work. Some of the types of adaptations should be previewed in this discussion:

Migration to warmer latitudes
Migrations to lower levels of soil or water
Migrations into sheltered area - caves, hollow trees, buildings, etc.
Coping directly with cold
Dormancy
Increased activity and food intake
Changes in color and body insulation
Use of insulated nests

Specific ECO objective: Students will explore adaptations of organisms that help them survive the conditions of Iowa winter.

Anticipated outcome: (concepts) The understanding that life continues through the winter months.

Procedure: Working in teams of two or three, students will investigate a number of winter habitats - observing conditions as well as the kinds of organisms found in these habitats. (It may be permissible to collect samples of some of the organimsm for additional indoor observing). Suggested habitats:

Under and inside rotting logs
Under shaggy bark of trees
Inside plant galls
Among leaves on ground
In top layer of soil, no more than one foot deep
In lower layer of soil, more than one foot deep
In debris at bottom of pond
In debris at bottom of stream
Among stones at bottom of stream
Among first-year leaves of mullein
In unheated buildings and hollow trees
In caves or cellars
In heated buildings
In snow banks

A follow-up discussion based on the field work may be used to summarize the findings.

Materials needed: (Teacher's responsibility) Pencil, note book, collecting jars and any digging equipment available.

Materials needed: (ECO responsibility) Shovels, trowels, hand ax, thermometers.

Suggested evaluation: Student reports, objective quiz.

WIND GAUGES

The wind gauges should be made from cardboard. The cardboard back from an 8-1/2 x 11 inch tablet of writing paper is ideal.

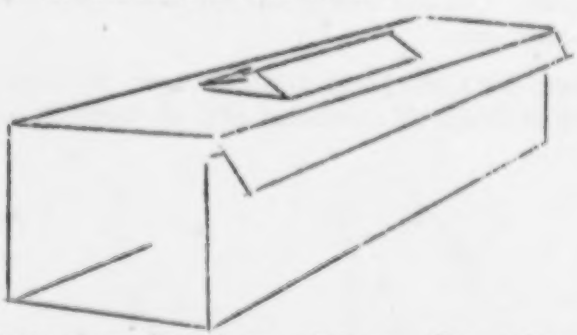
Trace the pattern of the gauge onto the cardboard. (For classroom use, duplicate a pattern for each student.) With a ruler and the point of a knife score all the lines which are marked "score". Scoring means to cut into the cardboard only a little way so that it will fold easily along the line of the score. The scoring cut should be on the outside of the fold. Note that two short scores are to be done on the reverse side.

Cut completely through the cardboard along the lines marked "cut". Tape the folded flaps where they are marked.

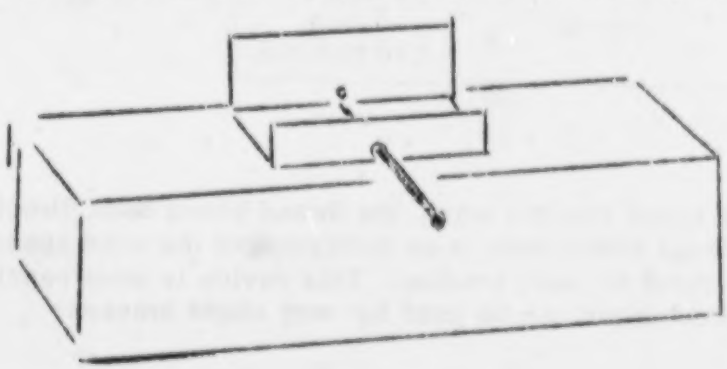
Assembly:

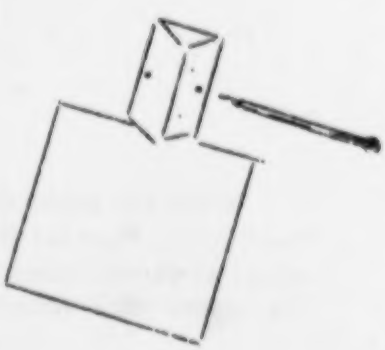
1. Tunnel wind gauge

Fold along scored lines to make a box with open ends. Tape the long side — flap down to the side of the box.

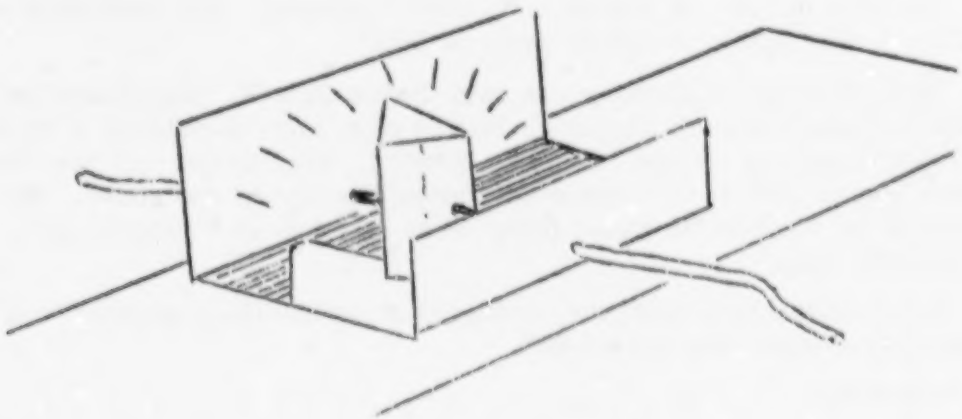


Open the small flaps so that they point up. Use a large pin or other sharp metal point to make holes at the dots. Also make holes at the dots on the handle of the wind vane after it has been folded and taped.





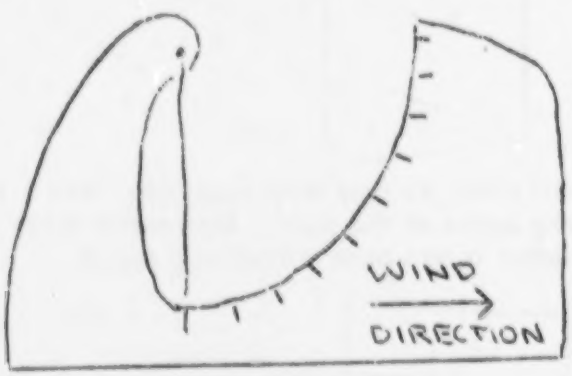
Put the wind vane inside the tunnel so that the handle points up through the hole. Shove a straightened paper clip or other wire through all four holes to support the vane. Marks can be made on the flap next to the handle of the vane to indicate wind speed when the tunnel is pointed at the wind.



2. Wind direction finder and speed indicator

Cut out of stiff cardboard. Make a small hole at the dot. Tie a thread through the hole. Cut the thread off so that it just reaches the inside of the curve of the indicator.

If the thread does not hang straight down (if it is curly) rub some light-weight oil into it (corn oil, mineral oil, or three-in-one lubricating oil).

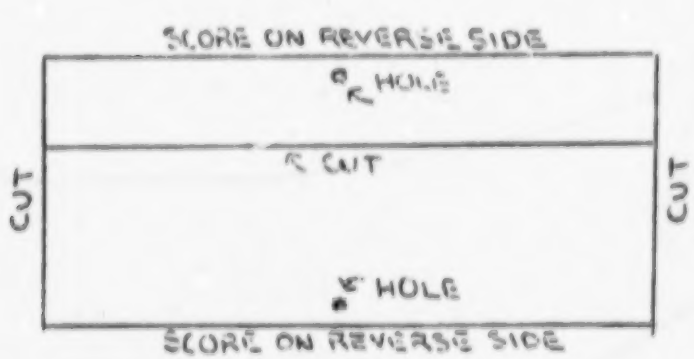


When the indicator is aimed into the wind, the thread blows back directly over the curve. How far the thread blows back is an indication of the wind speed. Mark equal divisions along the curve for easy reading. This device is more sensitive than the tunnel wind speed indicator and can be used for very slight breezes.

SCORE

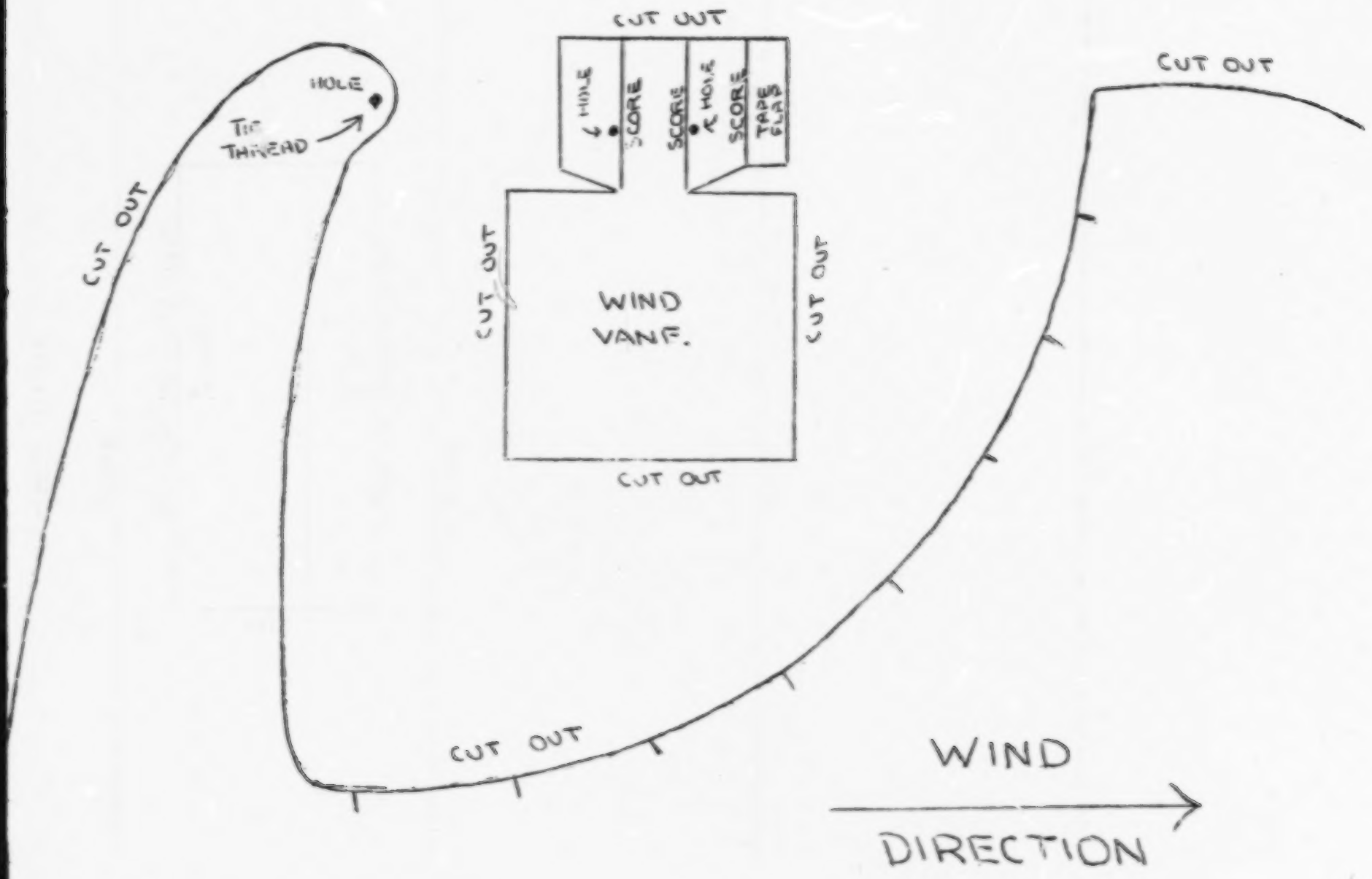
SCORE

SCORE



SCORE

TAPE FLAP


CUT OUT
HOLE
TIE THREAD
CUT OUT
CUT OUT
HOLE
SCORE
SCORE
HOLE
SCORE
TAPE FLAP
CUT OUT
WIND VANE
CUT OUT
CUT OUT
CUT OUT
CUT OUT
WIND
DIRECTION

Topic: Air Suggested Grade level: 3 Locality:

Activity or problem: Wind variables.

Background needed: Know how to read a thermometer.

Specific ECO objective: Students will investigate the micro-climate relative to temperature, water availability and type of vegetation as determined by insolation.

Anticipated outcome: (concepts) Students will observe that wind is created by differences in air temp.

Procedure: Students will investigate the action of wind in a natural area by measuring the air temperature at the top of the hill and at the bottom. Using a smoke source students will observe the patterns and movements of wind currents.

Repeat the observations at different times for comparisons: sunny day, cloudy day, summer, winter, spring, fall.

Survey and record any natural features such as outcropings, slumps, etc. which affect wind patterns (possible mapping).

Materials needed: (Teacher's responsibility) Pencil, note book.

Materials needed: (ECO responsibility) Thermometers, smoke source.

Suggested evaluation: In a given situation, students can predict wind patterns.

Topic: Community Relationships Suggested Grade Level: 3 Locality: school area or park

Activity or problem: Mapping and recording what our environment contains (must know what is found in the environment before we can conserve it).

Background needed: There would need to be "class tree experts", from previous work on tree identification. Some knowledge in use of maps.

Specific ECO objective: Students will investigate the micro-climate relative to temperature, water availability and type of vegetation as determined by insolation.

Anticipated outcome: (concepts) Students will nore closely observe their local environment. Students will learn about mapping and reading mpas. Students will use skills in tree identification.

Procedure: Class will draw a map of a school area, local park, streets, and of own home. Each student shows his own home location on the map. Using the "class experts" on tree students can check all trees in the area and identify them. Place at approximate location on map the kinds of trees found at that location. Students could make note about conditions of the trees - dead branches - leaves, etc. Class could return later and compare notes.

Materials needed: (Teacher's responsibility) Pencil, note book, graph paper.

Materials needed: (ECO responsibility) None.

Suggested evaluation: Teacher could give students a similiar map and students could interpret it.

Topic: Community Relationships Suggested Grade Level: 3 Locality: McFarland Lake, Hickory Grove

Activity or problem: Pond life (I).

Background needed: Observation and recording skills.

Specific ECO objective: Students will investigate the micro-climate relative to temperature, water availability and type of vegetation as determined by insolation.

Anticipated outcome: (concepts) Observation that temperatures produce decided differences in all pond life behavior. Observation that not all organisms behave in the same manner.

Procedure: Visit a pond area in summer at 2 or 3 time periods in one day. Record observations as to the differences which are easily seen, heard, and felt such as life forms on the surface, specific sounds you hear, and heat of the sun.

Compare observations with another student. What things are alike -- what things were different. What observable changes did you see as the surface water warmed (less oxygen -- less active movement by fish that rise to the water interface and fan the water slowly in order to infuse air into the water, as the surface temperature cools. Students should hopefully come to the conclusion that as temperature varies, a corresponding variation in breathing rates occurs.)

Develop period observations into a "pond journal". Encourage students to write detailed observations such as development ---- Subsequent dormant stages of life forms. Spring ---- spring.

Materials needed: (Teacher's responsibility) Pencil, note book.

Materials needed: (ECO responsibility) Thermometers, wind gauges.

Suggested evaluation: Teacher evaluation of student observations and conclusions, rating scale test, check list test.

Name_____

SHARPENING YOUR OBSERVATIONAL SKILLS ON THE WAY TO THE LAKE

1. What are the names of the streets and roads between School and McFarland Lake?

   (in order) a. _____ b. _____ c. _____

   d. _____ e. _____

2. What kinds of roads do we travel upon? (blacktop, gravel, etc.) a. _____

   b. _____ c. _____ d. _____

3. Do you see some signs of man's progress? _____

   _____

   _____

4. What businesses and industries do you see along the way? a. _____

   b. _____ c. _____ d. _____

   e. _____ f. _____

5. Compare the city houses to those in the country. How are they different? How are they the same?

   Same? _____

   _____

   _____

6. On our last trip we traveled southwest, but this time we are going _____

7. Sketch the cloud forms in the sky and label them.

8. What animals do you still see outside? a. _____ b. _____

   c. _____ d. _____ e. _____

9. How are the fields different now than they were on the last trip? _____

_____

_____

10. Do you see any effects of prolonged rain on the land? _____

_____

11. Do you see any signs of pollution? _____

_____

_____

12. The color of the soil shows humus content is high or low. Why? _____

_____

_____

13. Do you notice some devices used to slow down erosion of the soil? _____

_____

_____

14. As we travel north what happens to the landscape? _____

_____

_____

15. Are most trees in this area broadleaf or evergreen? (Underline one)

Topic: Community Relationships Suggested Grade Level: 3 Locality: school area or park

Activity or problem: Mapping and recording what our environment contains (must know what is found in the environment before we can conserve it).

Background needed: There would need to be "class tree experts", from previous work on tree identification. Some knowledge in use of maps.

Specific ECO objective: Students will investigate the micro-climate relative to temperature, water availability and type of vegetation as determined by insolation.

Anticipated outcome: (concepts) Students will more closely observe their local environment. Students will learn about mapping and reading mpas. Students will use skills in tree identification.

Procedure: Class will draw a map of a school area, local park, streets, and of own home. Each student shows his own home location on the map. Using the "class experts" on tree students can check all trees in the area and identify them. Place at approximate location on map the kinds of trees found at that location. Students could make note about conditions of the trees - dead branches - leaves, etc. Class could return later and compare notes.

Materials needed: (Teacher's responsibility) Pencil, note book, graph paper.

Materials needed: (ECO responsibility) None.

Suggested evaluation: Teacher could give students a similiar map and students could interpret it.

Topic: Life Forms Suggested Grade Level: 2-3 Locality: local parks

Activity or problem: Looking at tree leaf forms.

Background needed: Recognition of different shapes of leaves from trees.

Specific ECO objective: While visiting a timber tract, students will investigate the complexity of the interrelationships of life in a forest.

Anticipated outcome: (concepts) Students will see that simple leaf patterns may be pinnately veined or palmately veined.

Procedure: Take students on a nature hike and point out the nature of the veins of leaves. How they are different and alike.

Matierials needed: (Teacher's responsibility) Pencil, note book.

Materials needed: (ECO responsibility) Supply of simple - pinately and palmately veined leaves. Supply of paper, supply of charcoal pencils.

Suggested evaluation: Students should be able to distinguish between the types of veination by making choices between leaves.

Topic: Life Forms Suggested Grade Level: 3-5-7 Locality: timber tract

Activity or problem: Go on a bird nest hunt (best in fall and winter).

Background needed: Observation skills, basic information about birds, their habitat, etc.

Specific ECO objective: While visiting a timber tract, students will investigate the complexity of the interrelationships of life in a forest.

Anticipated outcome: (concepts) Students will have greater appreciation and understanding of the instinctive behavior of nest-building. They will become more aware of the materials used, types of nests, and adaptations of species within an environment. Students may be able to recognize the nests of different common species.

Procedure: Students will:

Search for the abondoned nests of birds. Note the location of the nest - marsh, meadow, woods, in grass or leaves on the ground. Note the shape of the nest. Measure its width and depth.

Find out what a nest is made of. Take it apart, bit by bit. Make separate piles of the different materials used to construct the nest. Note whether or not man-made materials are included. Count the number of pieces of different materials. Speculate as to the number of flights necessary to gather the material.

Observe how the nest was constructed. Try to reconstruct it.

Try to identify the kind of bird that built the nest.

Have students collect nesting materials - colored yarn, dried grass, hair, etc. - and observe what species of birds use certain materials.

Collect several nests of a particular kind of bird, such as the robin. Keep careful notes of the location of the nests and compare the different materials used. See if the differences in kinds and amounts of material used in the nests are related to location.

Materials needed: (Teacher's responsibility) Pencil, note book.

Materials needed: (ECO responsibility) Hand lens, probes. Reference books on bird nests: Birds' Nests by Headstrom, Ives Wasburn, Inc., New York 1941, if available. Birds by Zim and Gabrielson, Golden Press, New York, 1956.

Suggested evaulation: Discussion. Objective test - matching nest types with appropriate environments.

Topic: Life Forms Suggested Grade Level: 3, 5 or 7 Locality: timber tract

Activity or problem: Be a twig detective - winter or early spring activity.

Background needed: Some skills in tree identification - at least, by the leaves if not the bark and tree shape. Vocabulary of twigs - terminal bud, leaf scar, bundle scar, lenticels, bud scars.

Specific ECO objective: While visiting a timber tract, students will investigate the complexity of the interrelationships of life in a forest.

Anticipated outcome: (concepts) Students will become more aware of the differences in the growth of various trees - the growth per year in twigs (length and diameter), the way leaves and new twigs emerge, factors influencing the growth, the means by which buds are protected during the winter.

Procedure: Students will observe twigs of many types of trees.

Observe bumps and markings on a twig, especially the buds. Locate terminal buds and side buds.

Examine and compare the bud coverings of different trees to see how they protect the tissue inside the buds.

Look at the base of terminal buds to see where scars will be left by bud scales when they fall away from the base of an opening bud. Find bud scars on the same twig which indicate the amount of new growth each year. Measure the growth using a tape measure to find length and calipers to find the increase in diameter.

Locate leaf scars on a twig which show where leaves were growing.

Use a magnifying glass to examine a leaf scar in order to see bundle scars. Compare the number of bundle scars on several leaf scars on a twig and note any differences.

Notice small speckles along the bark of a twig. These are called lenticels. Air goes into and out of the twig through them.

Clip some twigs from trees or shrubs and bring them indoors. Place them in water near a window to observe the development of buds. Students should be able to observe the opening of bud coverings.

Compare the yearly growth of twigs between trees of the same or different species.

Continue to observe the twigs of trees as spring progresses. They should be able to see that side buds usually grow into leaves and flowers. The terminal bud grows into a new twig.

(con't.)

Materials needed: (Teacher's responsibility) Pencil, note book.

Materials needed: (ECO resposibility) Hand lens, pruning shears, tape measure, caliper (for measuring diameter of a twig.)

Suggested evaluation: Students will be able to compare twigs of various trees and recognize new growth and signs of previous growth. Some may be able to identify common trees by the twigs.

Topic: Life Forms Suggested Grade Level: 3 Locality: any area

Activity or problem: Dry printing a photographic process.

Background needed: Some knowledge of light, and light sensitive paper.

Specific ECO objective: Students will investigate the micro-climate relative to temperature, water availability and type of vegetation as determined by insolation.

Anticipated outcome: (concepts) Knowledge of a process that could be cheaply used to produce individual plant keys. Also will be an easy first step in understanding film processing.

Procedure: Making the print: Cover the edges of the glass with masking tape for safety, and to form a border on the finished print. The tape also affords a place for the fingers to hold the assemble during exposure to the sun, without showing a print of the fingers as well as of the leaf or other material being printed.

In the bottom of the larger jar, place a tissue or paper towel saturated but not soaked with ammonia. Actually enough ammonia to fill the jar with fumes is all that is needed.

Place the leaf to be printed, on the glass, either side up, then place a sheet of Diazo paper, yellow or glossy side down, over the leaf, being careful not to expose the paper to strong light while handling. Place the plywood, cardboard, or magazine over the paper to hold it in place.

Turn this assembly, glass side up, and expose to strong sunlight for a few seconds until the paper turns white. Remove from the sunlight and place the exposed paper in the jar containing the ammonia fumes and close the cover.

The ammonia fumes will quickly develop the print. If development is uneven, remove the print from the jar reversing the ends of the paper so that the undeveloped portion will be in the bottom of the jar where the ammonia fumes are more concentrated.

Remove the paper from the jar when the print has developed to a deep even color.

The print is then completed and will last indefinitely.

Label with correct variety name.

Materials needed: (Teacher's responsibility) Pencil, note book, old magazine for each student.

Materials needed: (ECO responsibility) Diazo, Driprint or Ozalid paper, glass sheets, plywood sheets, masking tape, large mouth gallon jug, household ammonia.

Suggested evaluation: Inspect the print that the student produces.

Topic: Life Forms **Suggested Grade Level:** 3 **Locality:** any area

Activity or problem: Spying on birds (bird watching).

Background needed: Observation skills, basic understanding of birds - their differences in body, size, shape, movements, habits, markings, color, song.

Specific ECO objective: While visiting a timber tract, students will investigate the complexity of the interrelationships of life in a forest.

Anticipated outcome: (concepts) Students become more aware of differences in birds and increase their ability to identify common species. Students will be able to note the relative frequencies of particular species during the seasons.

Procedure: Students will observe birds in various locations and record their findings.

Name	When	Where	Size	Feet	Beaks	Color	Special features
	Date: month, day Time of day: morning afternoon evening night	ground grass post tree etc.	head to tail in inches or compare to another bird	grasping climbing webbed perching	seed cracking insect chisel spear prober strainer	patterns markings description	eating? food? behavior flight pattern

Materials needed: (Teacher's responsibility) Pencil, note book, any extra binoculars the students can furnish, any field guides available.

Materials needed: (ECO responsibility) Binoculars for each 3 students, pictures of some birds beaks and feet, field guide for birds.

Suggested evaluation: Individual inventory and evaluation of field notes.

Topic: Life Forms Suggested Grade Level: 3 Locality:

Activity or problem: Hunting insects in winter.

Background needed: Knowledge of the forms of insect life. Insect collecting skills - knowledge of ways of collecting insects and equipment.

Specific ECO objective: Investigate the micro-climate relative to temperature, water availability and type of vegetation as determined by insolation.

Anticipated outcome: (concepts) Students will realize that insect life in the winter does not cease. Insects survive the winter in immature as well as mature forms. Their winter homes may be quite different from their habitat in warmer seasons. Protective coloration is one adaptation necessary for the survival of the species.

Procedure: Students will:

Look for insects in the winter. Search under loose boards and shingles, inside culverts, under bridges and eaves of buildings, and in hollow trees. Look at stems of dry weeds and and bushes and dead logs. Collect some soil from varying depths. There are some adults insects found in and around the snow in later winter or early spring.

Record where insects were found and perhaps the temperature of the location.

Sort and try to identify the insects and other life collected. Compare the kinds that come from leaves, soil, rotten wood, and other places to see if there is any relationship between the form and color of the creatures and where they were found.

Place insects in containers (especially the pupae) so they may be taken back to the classroom for observation.

Materials needed: (Teacher's responsibility) Pencil, note book, little boxes or bags for collection, jars, identification keys if available.

Materials needed: (ECO responsibility) Tweezers of forceps, hatchet, crowbar, jars, thermometer, spade, identification books on insects: How to Know the Immature Insects by H. F. Chu, Wm Brown Co., 1949.

Suggested evaluation: Personal interview. Teacher observation of student records.

Topic: Life Forms Suggested Grade Level: 3 Locality: any area

Activity or problem: Collecting spider webs to compare general shape.

Background needed: Knowledge about spiders - their habitats.

Specific ECO objective: Investigations of ecological relationship in central Iowa.

Anticipated outcome: (concepts) Students will observe differences in the structure and design of spider webs. They may be able to identify the webs of common spiders.

Procedure: Students will search for spider webs in various field locations:

Find a web in a location where a piece of cardboard can be brought against it without running into twigs.

Observe the spider webs before collecting them. Note the surrounding area. Speculate as to why the spider selected that location. What insects might be caught in it? How does the web work? How does the spider move around on the web? Which threads of the web are sticky? What are some habits of the spider?

Coat the web lightly but thoroughly with paint, on both sides if possible. Begin about 2 feet away from the web and spray from any angle.

While the paint is still "tacky", press the cardboard lightly against it. Cut the supporting threads around the web off. When the paint is dry, cover the web with a sheet of glass, plastic or contact paper. On the back of the cardboard, write the location of the web, date collected, name of collector, and, if possible, the kind of spider.

Materials needed: (Teacher's responsibility) Pencil, note book, reference books.

Materials needed: (ECO responsibility) Sheets of cardboard, spray paint, contact paper, scissors, adhesive tape, reference books.

Suggested evaluation: Students can classify webs according to particular shapes and demonstrate an understanding of how they work.

Topic: Life Forms Suggested Grade Level: 3 Locality:

Activity or problem: Tree identification

Background needed: None

Specific ECO objective: While visiting a timber tract, students will investigate the complexity of the interrelationships of life in a forest.

Anticipated outcome: (concepts) Students become familiar with the leaves of some local trees. "Class experts" become very familiar.

Procedure: Handout to each child a NASCO nature study aid leaf replica. Example (oak to one student, elm to another student, etc.) The student will place leaf replica face down on an ink pad and press down on the replica. Place a piece of clean paper on top of leaf replica and rub hard over the paper.

Study the print and identify the tree. The student becomes the "class expert" on this tree. Send students out to collect leaves to be identified by the "class experts."

Materials needed: (Teacher's responsibility) Pencil, note book.

Materials needed: (ECO responsibility) Leaf replicas.

Suggested evaluation: Collect leaves from certain trees and see if students can identify them.

Topic: Life Forms Suggested Grade Level: 3 Locality: any wooded area

Acitivity or problem: Examining the bark of trees (color and texture).

Background needed: Some knowledge of tree identification - perhaps previous work identifying trees using leaves.

Specific ECO objective: While visiting a timber tract, students will investigate the complexity of the interrelationships of life in a forest.

Anticipated outcome: (concepts) Students will be able to classify trees according to the color and texture of the bark. They will see that the texture of the bark becomes more pronounced as the tree reaches maturity. They may be able to identify common trees by their bark.

Procedure: Students will observe the trees of a woodland area:

Feel the roughness and compare the texture of mature trees. Note the bark found on the trunk, large branches, smaller branches, etc. Observe the color and texture of the bark at different locations on the same tree and compare it with other varieties of trees.

Use newsprint, charcoal, and crayons to take rubbings of the bark of the mature trees. Compare these with immature trees to see if they can see similiarities and differences as a tree matures.

Try to identify trees using the bark - texture and color. If students are not sure of their identification have them observe the leaves, fruit, shape, etc.

Materials needed: (Teacher's responsibility) Pencil, note book.

Materials needed: (ECO responsibility) Keys for tree identification.

Suggested evaluation: Personal interview, objective field test classifying trees according to color of bark (grey, brown, white, etc.) and texture (furrowed, smooth, scaly, etc.).

Topic: Life Forms Suggested Grade Level: 3 Locality: ISU or hybrid seed area

Activity or problem: Observing plant breeding experiments.

Background needed: None

Specific ECO objective:

Anticipated outcome: (concepts) The student should have a better understanding of the economically important varieties of farm grains.

Procedure: Observe plant breeding experiments to help determine the value of man-made varieties or strains. Observe conservation practices on an experimental farm. Try to identify some of the common plants that have been hybridized.

Observe the dependence placed on proper recording and understanding of the various weather phenomenon.

Materials needed: (Teacher's responsibility) Pencil, note book.

Materials needed: (ECO responsibiltiy) None

Suggested evaluation: Objective quiz.

Topic: Soil Suggested Grade Level: 3 Locality: any area

Activity or problem: Soil type profile.

Background needed: None

Specific ECO objective: While visiting a natural growth area and a cultivated area, students will conduct soil investigations.

Anticipated outcome: (concepts) Students will increase observation, recording and conclusion skills.

Procedure: Using a quadrat sampling system in a natural growth area students will collect soil samples from each point and label the samples as to their position in the quadrat system. Fill sample jars 1/3 full of soil and add water until almost full. Shake the water-soil mixture thoroughly and place jars aside to "settle out" for at least 48 hours. Students will observe that the coarser and heavier particles settle out first, 2nd layer -- fine sand, 3rd layer -- silt and 4th layer -- clay. Do comparison studies of samples from each quadrat section. Students should measure and record the relative concentrations of soil types and assign a name to the soil by referring to particle layer (or layers) which is most predominant.

Return to each quadrat location with the stratified sample and compare concentrations in the "quadrat digging" to the quadrat sample.

Make repeated visits to the quadrat at seasons of the year for observations of soil cover, effects of rainfall, depth of snowfall, runoff, soil compactness, etc.

Materials needed: (Teacher's responsibility) Pencil, note book, sample jars, collecting bags, soil compactness tester (see enclosure).

Materials needed: (ECO responsibility) Trowels or digging equip.

Suggested evaluation: In a given situation students will be able to compile data from a soil sample and from inferences of previous data be competent in predicting the most prominent soil type in a profile.

Topic: Soil Suggested Grade Level: 3 & 5 Locality: stream or lake area

Activity or problem: Bottom sampling of stream beds and shallow shorelines of lakes.

Background needed: Ability to map on grid system - make decisions in classification of materials.

Specific ECO objective: Students will investigate surface and subsurface water in a watershed that includes lakes, ponds, and streams.

Anticipated outcome: (concepts) Continued development of observation skills and coming to conclusions.

Procedure: Students will take bottom samples on a grid system of 1 dm. (or scale appropriate to the area).

Comparison they will determine categories for chart notation -- mud, sand, clay, sand and gravel, etc., and decide upon a notation system, e.g., s or sg.

Using this system, students will proceed to map the bottom material and attempt to determine the boundary lines of deposits.

Materials needed: (Teacher's responsibility) Pencil, note book, graph paper.

Materials needed: (ECO responsibility) Sediment scoop, measurement system.

Suggested evaluation: Students should be able to make an "educated guess" as to why deposits differ as to quantity, type, and variety.

Topic: Soil Suggested Grade Level: 3 Locality:

Activity or problem: How is soil formed?

Background needed: None

Specific ECO objective: Students will investigate the earth's crust in order to determine the effects of former environments on various ecological relationships.

Anticipated outcome: (concepts) Students will see some of the effects of weathering on the rocks and from this be able to discuss the parent rocks role in soil formation.

Procedure: Take class on a treasure hunt. The students will be looking for rocks and pebbles.

Show students how to use the trowels and sifters by taking samples of the dirt.

After students have been divided into workable groups they are sent out to collect pebbles. The students must sift the dirt in order to collect the pebbles.

During the activity children will discover that rocks are found in soil and that there are many different kinds.

Have the students rub two rocks of sandstone together which will produce fine particles like soil.

Materials needed: (Teacher's responsibility) Pencil, note book, plastic bags.

Materials needed: (ECO responsibility) Trowels, different size sifters.

Suggested evaluation: Ask students how do you suppose rocks make soil when no one rubs them together (rain, moving water, wind, plant roots, etc.) plus other discussion questions of this type.

Topic: You in Your Environment Suggested Grade Level: 3 or 8 Locality: any area

Activity or problem: Odor classification.

Background needed: An understanding of the 5 senses and some of their uses.

Specific ECO objective: None.

Anticipated outcome: (concepts) Environments differ. In chemical changes, atoms react to produce change in the molecules. An improved awareness of their sense of smell and the difficulty of classifying smells other than good or bad.

Procedure: Take students out on an odor investigating field trip. Do not provide them with prior information as to what odors to expect. Only inform them that for each new odor they are to discuss and describe it and, if possible, locate and identify what is causing the odor.

When you have finished the field trip have the students discuss with you and try to develop an odor classification system.

Sounds and colors can be classified in definite order, but smells seem to show a bewildering diversity.

Yet in invertebrates odors must be easily identified in extremely small quantities and over long distances in order that a male can seek out and identify a female of his own specie. These scents are so subtle and delicate that a human being is unable to perceive it.

Many animals use scents to recognize friend or foe. In the mammals only primates and cats are sight oriented, but the whole class of birds is sight-guided. The bats constitute a unique group; as they track down their prey with the aid of their sense of hearing.

Take students on a field trip and have them describe each odor that they perceive. See if they can set up an odor classification system.

Hans Henning developed such a system using only 6 classes.

1. Spicy
2. Flowery
3. Fruity
4. Resinous
5. Putrid
6. Burnt

However, the woman that cried, "I have never known that there were such odors in the world!" is more nearly correct. The number of olfactory sensations or odors appears to be unlimited.

Materials needed: (Teacher's responsibility) Pencil, note book.

(con't.)

Materials needed: (ECO responsibility) None.

Suggested evaluation: Ask the student to indicate the order of their senses in terms of hunting value.

Topic: You and Your Environment Suggested Grade Level: 3-5-7 Locality: Preston Branch or area away from manmade noise

Activity or problem: Environmental sensitivity.

Background needed: An explanation that only through observation do we become aware.

Specific ECO objective: Students will investigate the micro-climate relative to temperature, water availability and type of vegetation as determined by insolation.

Anticipated outcome: (concepts) An awareness of self and environment.

Procedure: Take the class to a natural environment such as Preston Branch. Lay out a course or path of distribution. Walk the class along this course stationing one student every so many yards until all are separately located.

The student is to sit quietly for 15 minutes and become a quiet part of the environment. He is to observe everything in his immediate area using only his five senses. Sight, smell, touch, taste, and hearing.

The student will make a chart recording his sense impressions during his observation period.

When the class is re-assembled various methods of treatment of information may be tried from oral to written essays.

Materials needed: (Teacher's responsibility) Pencil, note book.

Materials needed: (ECO responsibility) None.

Suggested evaluation: Reading or listening to the summary of each student.

Topic: Water Suggested Grade Level: 3 & 8* Locality: local city park

Activity or problem: Investigation of a paved desert.

Background needed: Realization that climates vary. (Example: Desert vs. rain forest.) Students should have experiences in reading thermometers.

Specific ECO objective: Students will investigate the micro-climate relative to temperature, water availability and type of vegetation as determined by insolation.

Anticipated outcome: (concepts) The sun is the earth's chief source of radiant energy - there are many forms of energy - environments differ.

Procedure: Locate several types of paved desert: A concrete sidewalk or road, a stone sidewalk or road, a brick sidewalk or road, a graveled path or road, an asphalt path or road, a wooden path or road, a path or road of hard-packed earth.

Investigate the temperatures above, on, and below this desert at different times during the day and compare these temperatures to temperatures of an area with grassy vegetation. If possible do the same for night, or at least early evening and morning temperatures. Temperatures of these areas during different months of a year should be recorded and tabled.

If time permits, light and moisture extremes should be investigated.

Upon inspection of the data the student should be able to formulate some conclusions about the effect of road ways upon the natural environment and what life would be like in a natural desert.

Materials needed: (Teacher's responsibility) Pencil, note book.

Materials needed: (ECO responsibility) Thermometers, light meter, clip boards.

Suggested evaluation: Graph results (class project). Students will see relationships between light and temperature at different localities.

* 8th grade will construct individual graphs and evaluate man's ever increasing attempt to provide artificial surface for travel and play.

Topic: Water Suggested Grade Level: 3-5-7-9 Locality: any snowbank

Activity or problem: Exploring a snowbank

Background needed: Study of light, spectrum, energy, conversion of light to heat.

Specific ECO objective: Students will invstigate the micro-climate relative to temperature, water availability and type of vegetation as determined by insolation.

Anticipated outcome: (concpets) Depending upon background, the student should arrive at some conclusion about light absorption in relation to the spectrum of visible light. Light to heat.

Procedure: Explore the snowbank with a thermometer to see what the temperature reading are at the top, middle, and bottom, just under the surface of the snow on the sunny side and shade side. Compare these temperatures with the air temperature.

Place 3 colors of construction paper on the sunny side of the snowbank along with a plain white paper. Place thermometer on snow surface just under paper. Check and record temperatures every five minutes for 20 to 30 minutes. Make a line graph of temperature vs. time. If time permits repeat process for shady side of snowbank.

Materials needed: (Teacher's responsibility) Pencil, note book, black, red, white, and green construction paper.

Materials needed: (ECO responsibility) Thermometer, light meter.

Suggested evaluation: Discuss the following statement and defend ideas: Which would absorb energy more rapidly - a dirty or clean snowbank?

Topic: Community Relationship Suggested Grade Level: 5 Locality: McFarland Lake, Hickory Grove

Activity or problem: Pond life equipment (II).

Background needed: Previous pond studies, knowledge of key usage.

Specific ECO objective: Students will investigate the earth's crust in order to determine the effects of former environments on various ecological relationships.

Anticipated outcome: (concepts) Student will observe interrelationships of the pond at seasons of the year. Students should begin to understand how complete is the community of the bond by the use of their equipment in collecting samples

Procedure: To aid in observing a pond over a period of time encourage students to:

Make an outline sketch of the pond (graph paper). Possible map the pond bottom using grid system and plumb line.

Use a camera to make photographic record at a series of fixed points.

Keep a regular record of water temp. and test water acidity with pH paper.

Observe turbidity of lowering white disk (top of a tin can) on a measured string -- note depth where it desappears from view.

Keep a record of the population of a particular plant at the pond edge in a particular spot at various times of the year.

Materials needed: (Teacher's responsibility) Pencil, note book, graph paper, collecting bottles, tin can lids.

Materials needed: (ECO responsibility) Collecting equipment.

Suggested evaluation: Observation of student use of equipment. Check list test on understanding of the pond community.

Topic: Community Relationships Suggested Grade Level: 5 Locality

Activity or problem: Microorganisms in water.

Background needed: Use of a microscope and a hand lens. Knowledge of techniques of slide preparation, skills in observation.

Specific ECO objective: Students will investigate the micro-climate relative to temperature, water availability and type of vegetation as determined by insolation.

Anticipated outcome: (concepts) Students will learn that water contains many microscopic living things which are invisible to the naked eye. There is a great variety of microscopic plants and animals which live in water. Pond life tends to occur in layers. Microscopic life can be affected by environmental conditions: food supply, light, temperature, etc.

Procedure: Collect microorganisms from a swamp, pond, lake or stream. Record location where sample was taken, temperature of water, and water depth.

Observe water samples with hand lens and microscopes. Record observations and sketch observable features of organisms. Note: 1) movement, 2) color, and 3) relative size.

Prepare infusions which can be returned to the classroom for continued observations under varying conditions.

Name common microscopic plants and animals. For many students this might be done by comparison with prepared slides or pictures.

Compare structural parts of microscopic life and discuss their adaptations.

Try to observe and determine what feeds off the microscopic life to establish a food web in various aquatic communities. Can you figure out which animals prey on others? How do the different animals move? Can you find an animal that is reproducing? What happens when you decrease or increase the temperature or light?

Materials needed: (Teacher's responsibility) Pencil, note book, containers, infusion materials.

Materials needed: (ECO responsibility) Microscopes, hand lens, medicine droppers, slides, labels, prepared slides or pictures of common microscopic life.

Suggested evaluation: Teacher evaluation of student observations and personal interview. Check list test of basic understandings and recognition of common microorganisms.

Topic: Fossils Suggested Grade Level: 5 Locality: Preston Branch

Activity or problem: Fossil Identification for correlation to types of environments.

Background needed: Be familiar with formation of some sedimentary rocks. Be able to recognize the difference between coarse, medium, and fine grain textures.

Specific ECO objective: Students will investigate the earth's crust in order to determine the effects of former environments on various ecological relationships.

Anticipated outcome: (concepts) Bodies in the universe are in constant change. Living things have changed over the ages. Living things are inter-dependent with one another and with their environment.

Procedure: In a natural setting (quarry, outcroppings, road cuts, stream cuts), where sedimentary types of rock occur and where fossils can be located, students will survey the area as to fossil locations. Locations should be mapped for later reference. Return to centralized area where students can place samples on a vertical elevation scale for purposes of identifying fossil-bearing layers.

Compare individual samples to geologic charts for identification of life forms and correlation to former environments.

Materials needed: (Teacher's responsibility) Graph paper, pencil.

Materials needed: (ECO responsibility) Fossil collecting equipment, identification material, tooth brushes, and tape measure.

Suggested evaluation: In a given situation students will be able to speculate as to the environment in existence during the life span od the fossil type.

Topic: Life Forms **Suggested Grade level:** 5 **Locality:** any area

Activity or problem: Finding variation in a species.

Background needed: Collection techniques (killing, mounting, etc.)

Specific ECO objective: While visiting a timber tract, students will investigate the complexity of the interrelationships of life in a forest.

Anticipated outcome: (concepts) Students will observe that all organisms have characteristics which make them unique.

Procedure: Students will collect and survey a specific species of insect to investigate variation in easily recognizable markings -- spots, stripes, etc.

Record variations in chart form ex:

Insect form: Lady bugs

characteristics: wing color	spot shapes
red	round
reddish orange	eliptical
etc.	etc.

As students gain expertise in this method, observations will disclose that there are numerous variables and combinations of variables that make each specimen unique -- spot location, blunt wing tips, pointed wing tips, etc..etc. Observations should also lead to understanding that most characteristics are oriented in symmetry.

Materials needed: (Teacher's responsibility) Pencil, note book, display mounts.

Materials needed: (ECO responsibility) Insect nets, killing jars, insect pins.

Suggested evaluation: In a given field situation students will show proficiency in collecting and sorting insects by a pre-determined set of character variables.

Topic: Life Forms Suggested Grade Level: 5th or 7th Locality:

Activity or problem: Collecting water life in streams and ponds.

Background needed: Ability to distinguish between plants and animals and to categorize life forms.

Specific ECO objective: Students will investigate surface and subsurface water in a watershed that includes lakes, ponds, and streams.

Anticipated outcome: (concepts) Students will see observable differences in the water life found at depths and in varying locations. Students may compare quantitative amounts of water life.

Procedure: Students will:

Seine for examples of water life at various depths at pond and stream locations.

Sort water life into categories of plant and animal life. Ability to classify will determine grade level. Elementary may classify according to plant and animal.

Record results of seining at various water depths and compare.

Record results of water life obtained in different locations (eddies, potholes, rapids, shallows, etc.) and compare.

Correlate amount of water life with water source, season, stream velocity, climatic conditions.

Draw some conclusions as to the different habitats of water life -- temperature, depth, velocity, food sources, etc.

Materials needed: (Teacher's responsibility) Pencil, note book, plankton nets - fine grade - could be made by students, depth measurements - plumb line.

Materials needed: (ECO responsibility) Keys for classification of water life as categorizing becomes more complex.

Suggested evaluation: Teacher observation of student records. Student ability to predict water life found at varying depths and locations.

Topic: Life Forms Suggested Grade Level: 5 Locality: park area or Preston Branch

Activity or problem: Story in a tree stump.

Background needed: Observation skills, understanding of time.

Specific ECO objective: While visiting a timber tract, students will investigate the complexity of the interrelationships of life in a forest.

Anticipated outcome: (concepts) Students will note the abundance of life forms and evidence of life in the decaying tree. They will realize that the histroy of a tree is briefly related in the stump.

Procedure: Students will observe a large, old stump in a forest area and investigate:

1. How old was the tree?
2. Why are the rings different distances apart?
3. At what time of year do you think the tree grew the most?
4. What kind of tree was it? (deciduous, coniferous, or more specific)
5. What evidence can be found of animals that have visited or used the stump? (tunnels of ants, beetles, spiders, rodents, bird droppings, partly-eaten acorns, etc.)
6. What plants are growing in the stump dust?
7. Are there any signs which tell you what may have happened to the tree?
8. What will eventually happen to the tree?
9. Do you see any signs of what might happen in the area where this tree once stood? (seedlings?)

Materials needed: (Teacher's responsibility) Pencil, note book.

Materials needed: (ECO responsibility) Hand lens.

Suggested evaluation: Have students dramatize the life story of the tree including factors affecting its growth. Creative writing experience - writing about the life of a tree as though the student was the tree.

Topic: Soil Suggested Grade Level: 5-9 Locality: selected road cut

Activity or problem: Visit to a road cut to study erosion effects.

Background needed: Vocabulary: slump, creep, landslide, colluvium, texture, boulders.

Specific ECO objective: Students will investigate the earth's crust in order to determine the effects of former environments on various ecological relationships.

Anticipated outcome: (concepts) The student should see: that the angle of slope will govern the type and amount of erosion, that plant type will retard erosion to various degrees, that soil type will effect rate of erosion, that removal of colluvium changes slope, that deposition occurs upon contact with larger body of water.

Procedure: Look for effects of a recent or prolonged rain on the soil.

Has there been formation of gullies?

Is there any evidence of slump, creep, or landslide?

Does the removal of colluvium aid in any slump or creep activity?

Can you trace the path of the soil from the road cut to a nearby stream?

What happens to the soil as it reaches the stream?

Make a list of some of the things that retard erosion.

What is the texture of the soil?

Has man attempted to retard erosion?

Materials needed: (Teacher's responsibility) Pencil, note book.

Materials needed: (ECO responsibility) Picks, shovels.

Suggested evaluation: Supply the student with an hypothetical situation and have them draw conclusions and suggest activities to retard erosion. Hypothesize as to origin of the soil.

Topic: Soil Suggested Grade Level: 5-7-9 Locality: timber tract

Activity or problem: Recreate soil profiles from soil samples taken from each tree community.

Background needed: Some instruction on proper sampling techniques.

Specific ECO objective: While visiting a natural growth area and a cultivated area, students will conduct soil investigations.

Anticipated outcome: (concepts) Awareness that decaying organic matter from different sites and from different communities build different kinds of soil from the same parent material.

Procedure: Take sample borings from each community. Keep the borings separated from each horizon. Measure the depth of each horizon. Recreate in the laboratory a profile which maintains the correct proportions of each horizon for each community. Students may work in teams. Save profiles for comparisons with soil types from other biomes such as grasslands.

Materials needed: (Teacher's responsibility) Pencil, note book, paper bags for soil samples.

Materials needed: (ECO responsibility) Soil borer.

Suggested evaluation: Recreated soil profiles will be examined.

Topic: Soil Suggested Grade Level: 4-6 Locality: any area

Activity or problem: Investigation of Soil Composition

Background needed: Some classroom discussion about collection techniques such as taking care not to contaminate the sample, use of ruler, some instruction relating to the use of caustic and poisonous chemicals.

Specific ECO objective: While visiting a natural growth area and a cultivated area, students will conduct soil investigations.

Anticipated outcomes: (concepts) Living things capture matter from the environment and return it to the environment. Living things are inter-dependent with one another and with their environment.

Procedure: In single-line transect grid system, in a natural growth area students will sample soils at 6" depths. Groups will return to centralized area where a corresponding paper grid has been positioned and place samples for observation. Attempt to identify humus content by color. Example, dark black -- high concentration of humus. Verify or correct observations by chemical testing -- 2 cm. of soil in test tube, add 3 times the volume of 2% sodium hydroxide -- shake well and let mixture settle for 24-48 hours.

Color of the solution will indicate amount of organic matter.

jet black liquid -- high organic content
dark brown -- medium organic content
any lighter shade -- low organic content

After taking soil samples at each location to determine the organic content, survey the area surrounding each sample point and attempt to do an approximate plant count - type and number, ex: short grasses, dandelions, etc. This could be facilitated by placing a quadrant frame on the ground surrounding the location and counting the plants inside of this enclosure. Record any animal life forms you observe above, on, and below the soil. Examine the soil for texture -- coarse, fine, etc. Examine with hand lens for soil particle size -- large, med., small. Record this information on your paper grid. Establish correlation sketch.

Material needed: (Teacher's responsibility) Paper, pencil.

Materials needed: (ECO responsibility) Trowels, test tubes, sodium hydroxide, clip boards, hand lenses, mm graph squares, quadrats, transect rope.

Suggested evaluation: Students will be able to differentiate soil with high→low organic content (humus). Students should be able to describe texture as related to partical size. Students should be able to postulate as to number and kinds of life forms the soil can support.

Topic: Soil Suggested Grade Level: 5 Locality:

Activity or problem: Life in the soil

Background needed: Recognition of different kinds of life forms, observation skills.

Specific ECO objective: While visiting a natural growth area and a cultivated area, students will conduct soil investigations.

Anticipated outcome: (concepts) Students will become aware of the many kinds of life in the soil. They will see that the numbers and varieties of organisms change with the location of the soil.

Procedure: Students will:

Look for life in the soil by digging soil samples (about a foot square and 6" deep) from a wooded area, a meadow, the edge of a swamp, and eroded field, etc.

Break the soil into bits or sift it through a screen.

Record the kinds and numbers of different plants and animals found in each sample. Sketches might be included. The way plants and animals are categorized will vary at grade levels. It may be based on just plant and animal or much more specific.

Materials needed: (Teacher's responsibility) Pencil, note book, containers.

Materials needed: (ECO responsibility) Spade, screen, keys for classifying and identifying soil life, berlese separator.

Suggested evaluation: Teacher evaluation of student observations and records, checklist of probable conclusions which might be drawn from observations.

Topic: Soils Suggested Grade Level: 5 Locality: city park or farm area

Activity or problem: Investigation of soils.

Background needed: Be able to measure a given amount of water accurately. Be able to read a timer or at least see the importance of accurate timing.

Secific ECO objective: While visiting a natural growth area and a cultivated area, students will conduct soil investigations.

Anticipated outcome: (concepts) There are characteristic environments, each with their characteristic life. Student should recognize that location can have much to do with the rate of infiltration.

Procedure: The student will determine the rate of infiltration of water in various soil types using location as the type determining factor.

Types of locations should include:

1. plowed field
2. grass land
3. area under broad leaf trees
4. area under evergreen trees
5. hill slope
6. valley floor
7. hill top
8. flower garden

The student should take uniform cans that have had both ends removed, place the can firmly against the ground and pour a measured amount of water into the can and time the interval until all the water has disappeared from view.

Materials needed: (Teacher's responsibility) Pencil, note book, 10 uniform cans with ends removed.

Materials needed: (ECO responsibility) Timing device.

Suggested evaluation: Students should prepare a bar graph indicating rate of infiltration for each type location.

Topic: Soil Suggested Grade Level: 5 Locality: Preston Branch

Activity or problem: Classifying and describing earth material.

Background needed: Some previous work on stream or wave energy, sedimentation rate, etc.

Specific ECO objective: Students will investigate the earth's crust in order to determine the effects of former environments on various ecological relationships.

Anticipated outcome: (concepts) Students will gain practice and expertise in developing and using a key in classification.

Procedure: Students will classify and describe samples of earth material according to observable characteristics.

origin of collection
color
grain size
texture
etc.

Sort into piles as classifying progresses until entire sample is used.

OR write a detailed description of each "sub-classification" sample. Compile into lists. Give the list to another person and see if he can pick out the sample from the total collection.

Materials needed: (Teacher's responsibility) Pencil, note book, large 24x36 sheets of paper, scratching tool (paper clip).

Materials needed: (ECO responsibility) Hand lenses.

Suggested evaluation: Successful application of a key in listing differences between earth materials.

Topic: Soils Suggested Grade Level: 5 Locality: any gravel pit

Activity or problem: Visit to a gravel deposit.

Background needed: Vocabulary: Gravel, limestone, sandstone, metamorphic, bedrock, igneous, sedimentary, granite, shale, glacier. Previous work: Have the students bring in samples of rock from the area. Group rocks in piles of some kind.

Specific ECO objective: Students will investigate the earth's crust in order to determine the effects of former environments on various ecological relationships.

Anticipated outcome: (concepts) Students should recognize that the gravel deposits of Iowa will contain a large variety of rocks that are not part of the bedrock of Iowa. He should then be able to draw conclusions as to how they might have gotten here.

Procedure: Have the student collect several pebbles from the gravel. They should get as many different kinds as possible.

Have the student sort the various kinds of rocks into separate piles.

Samples of various kinds should be taken back to the school for further identification.

Bring in terms erratic, regolith

Use plastic column with water to let a handful of particles settle out to show stratification.

Materials needed: (Teacher's responsibility) Pencil, note book.

Materials needed: (ECO responsibility) Plastic column.

Suggested evaluation: Pupil/teacher discussion, teacher's observation of the pupil's grouping of rock samples.

Topic: You and Your Environment Suggested Grade Level: 5 Locality:

Activity or problem: Effects of sound.

Background needed: Ability to use tape recorder.

Specific ECO objective: All.

Anticipated outcome: (concepts) Increased powers of observation through senses -- correlation of sounds to previous experiences.

Procedure: Students will record sounds (using tapes) at several different locations:

(a) street corner during rush hour

(b) beside a fast flowing stream, slow moving stream

(c) pond area

(d) wooded area, both coniferous and deciduous

(e) country road

etc.

After collecting a variety of recordings from sound locations, listen carefully to distinguish sounds. Return to each location and make note of the type of life forms and their physical condition (vigorous, showing signs of stress, etc.)

OR return to group of students, play tapes and have other students identify possible locations.

OR return to same locations during seasons of the year -- have students compare differences -- crickets chirping in late summer ----> sound of walking on snow packed area, etc.

Materials needed: (Teacher's responsibility) Pencil, note book, tape recorders, if available.

Materials needed: (ECO responsibility) Tape recorder.

Suggested evaluation: Check list tests, teacher observations.

Topic: Water Suggested Grade Level: 4 Locality: Brookside park, Ledges

Activity or problem: Stream or shallow shore bottom mapping.

Background needed: Know meaning of contour lines, location on grid system (possibly use of quadrants), contour of large features within the limits of a small chart.

Specific ECO objective: Students will investigate surface and subsurface water in a watershed that includes lakes, ponds, and streams.

Anticipated outcome: (concepts) Conclusions that slope of stream bed contributes to the rate of water movement. Discovery that areas with low relief need to be measured with small contour intervals. Desire to compare offshore contours to shoreline contours.

Procedure: Students will map the bottom of the stream or shore by the use of sounding techniques.

On a grid system take soundings at ½ meter or 1 meter intervals and transfer these measurements to a sounding chart. Draw in the contour lines of the underwater area.

Materials needed: (Teacher's responsibility) Pencil, note book, graph paper.

Materials needed: (ECO responsibility) Sounding line knotted at 1 decimeter intervals.

Suggested evaluation: Test the student's ability to draw conclusions as to stream or wave action under a variety of situations - minimal rainfall and high temperatures, excessive rainfall and high winds, etc.

Topic: Water Suggested Grade Level: 4-6 Locality: lake or stream

Activity or problem: Measuring water temperature in ponds or streams.

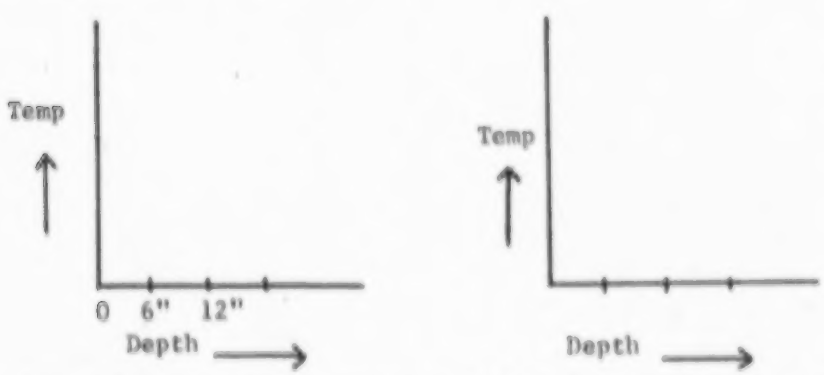
Background needed: Ability to read F° thermometer. Some practice and a method of recording data. Ability to compare two sets of information and come to generalizations about the information.

Specific ECO objective: Students will investigate surface and subsurface water in a watershed that includes lakes, ponds, and streams.

Anticipated outcome: (concepts) Students will know that water is cooler in the shade and warmer in sun -- that as water depth increases, temp. values decrease. (in summer)

Procedure: Using thermometers students will:

Measure temp. of surface of water in the shade and in the open where sun strikes the surface. Record results. Use levels in water of 6" intervals in shade and sun. Try for at least 4-6 intervals. Record readings at depths and time of day. Compile data in graphic form. (line/bar graphs)



Materials needed: (Teacher's responsibility) Pencil, note book, graph paper.

Materials needed: (ECO responsibility) Plumbed line in gradations of 6" intervals, F° thermometers, maximum-minimum thermometers.

Suggested evaluation: Use of Celsius (centrigrade) thermometers -- conversion techniques. Comparative study using collection of data at 7AM. 12 noon, and 6PM. Plot color coded line graphs for correlation. Repeat on a cloudy day, compare. Observation of life forms that appear to prefer "shady water" and encourage reasonable conclusions. Compare air temp. to water temp. Compare readings of various seasons.

Topic: Water Suggested Grade Level: 4-6 Locality: any lake

Acitivity or problem: Wave motion on shorelines (parrallel waves).

Background needed: Students should have some understanding of the following terms: refraction, wave length, crest, trough, fetch, parallel lines.

Specific ECO objective: Students will investigate surface and subsurface water in a watershed that includes lakes, ponds, and streams.

Anticipated outcome: (concepts) Students will see how water depth and bottom contour affects the refraction of waves.

Procedure: Observe wave action in a lake in at least two locations: 1) point, 2) bay. When there is wave action of at least two two types, 4-6" waves and 12" waves. Observe wave motion 100' off shore at both locations and also 10'. Record and describe the four different wave patterns and the wind velocity in each case. Measure water depth at each of the locations -- generalize as to why all waves tend to bend parallel to the shore.

Materials needed: (Teacher's responsibility) Pencil, note book.

Materials needed: (ECO responsibility) Plumb line, dye (vegetable).

Suggested evaluation: Interest inventory, teacher observation, check list test.

Topic: Water Suggested Grade Level: 4-5-6 Locality: McFarland Lake, Don Williams, Hickory Grove

Activity or problem: Movement of a water particle in a wave.

Background needed: Ability to determine wave length. Ability to generalize on wave crest against a given measure.

Specific ECO objective: Students will investigate surface and subsurface water in a watershed that includes lakes, ponds, and streams.

Anticipated outcomes: (concepts) There are many forms of energy. A gain or loss of energy affects molecular motion.

Procedure: Students will study the manner of wave form travel and generalize as to distance a given "amount, quantity, molecule" of water will travel in a ten minute period. Wave action should create a crest of at least 4-5 inches.

Place a large cork, half red and half white, with the white side into the water. Observe the float for another ten minute interval.

Record # of wave lengths that pass a given point in each time interval, wavelength, color of cork that shows above water, and distance the cork travels.

Diagram cork movement as they visualize it.

Materials needed: (Teacher's responsibility) Pencil, note book, graph paper. (Refer to "Nature and Science" Dec. 20, 1965.)

Materials needed: (ECO responsibility) Red and white cork, measurement stick, woodchips.

Suggested evaluation: Students should correlate particle movement to fact that all the water in a lake does not pile up on the downwind side. Should be able to describe particle movement as being circular within the period of the wavelength.

Topic: Community Relationships Suggested Grade Level: 6 Locality: 4-H camp

Activity or problem: Field study of small mammal populations (an overnight trip or 2 consecutive days).

Background needed: A study of life habits of the animals to be trapped.

Specific ECO objective: While visiting a timber tract, students will investigate the complexity of the interrelationships of life in a forest.

Anticipated outcome: (concepts) The student should discover the role of certain small mammals in the ecology of the communities sampled (consumer - predator). The student will discover the presence of species rarely seen. The student will discover that each species has its own habitat preference out of which it is not found.

Procedure: A snap-trap line will be established at two locations: (a) a meadow and (b) a woodland.

In the meadow place traps 3 to a cluster and 42 ft. between clusters, with 25 clusters. Place traps in runways where found.

In the woodland place traps next to logs and bases of trees, near rocks and stumps in a random manner. Place traps in each of the trees communities previously identified.

Bait traps with peanut butter or bacon grease. Trap-line must be run every 24 hours. A grid system may be used instead of a straight line of traps.

The mammals taken will be classified or identified and stomach contents will be analyzed. This information may be saved for development of a food chain or food web.

Record sites of capture with symbols on a map of the area.

Materials needed: (Teacher's responsibility) Pencil, note book.

Materials needed: (ECO responsibility) Snap traps, bait (peanut butter or bacon grease), map of area, tape measure, scalpel, key to mamals.

Suggested evaluation: The student will use a mammal key and identify a small mammal in presence of project personnel. Field notebooks will be examined.

Topic: Community Relationships Suggested Grade level: 6 Locality: lake or stream

Activity or problem: Effect of wave motion in shoreline locations on life forms.

Background needed: Techniques of observation and recording skills.

Specific ECO objective: Students will investigate the micro-climate relative to temperature, water availability, and type of vegetation as determined by insolation.

Anticipated outcome: (concepts) Students will see that the nature of life forms is dependent upon the environments, physical characteristics, and topography. Develop greater understanding of plant parts - their function and structure.

Procedure: Students will observe the water life forms in offshore lake areas and along beaches (sandy, rocky, and mud flat).

Sandbottom: Should note considerable wave action, finer particle material. Lack of plant forms due to unstable bottom. Few fish. Mostly crustaceans.

Mud bottom: Plant growth abundant depending water depth. (insolation) Burrowing type of animal forms.

Rock bottom and shore: Usually strong currents. Plants develop root parts for holding, and slender pliable stems -- concentration of leaf parts usually at the top. (insolation)

After repeated observations students will differentiate plant forms as to root parts, stem parts, and leaf parts. Observation of animal life forms should be concerned with shape and function.

Record observations and come to some general conclusions.

Materials needed: (Teacher's responsibility) Pencil, note book, extra face mask if students have them.

Materials needed: (ECO responsibility) Under water viewers.

Suggested evaluation: Rating scale test, individual inventories, interest inventory.

Topic: Community Relationships Suggested Grade Level: 6 or 7 Locality: city parks

Activity or problem: Identification of differences between trees through key use.

Background needed: None

Specific ECO objective: While visiting a timber tract, students will investigate the complexity of the interrelationships of life in a forest.

Anticipated outcome: (concepts) Students will learn to identify the common species of trees in the area. Student will become skilled at using a simple tree key. Student will become aware of the many different forms and characteristics of tree morphology.

Procedure: Students are to examine the differences in the characteristics of the flowers or fruit, leaves, bark and other characteristics which might be distinguishing ones, of three different trees each. Choice of trees should include those which are possible dominants or subdominant on the site chosen (upland, valley, north slope, south slope).

Materials needed: (Teacher's responsibility) Pencil, note book.

Materials needed: (ECO responsibility) Keys and trees, hand lenses.

Suggested evaluation: Bark, leaves, and fruit samples can be brought back to the classroom for a later evaluation.

Topic: Life forms Suggested Grade Level: 6 Locality: 4-H camp

Activity or problem: Making a plaster cast of animal tracks.

Background needed: Be able to recognize various tracks or be able to look at pictures of tracks and identify them by this method.

Specific ECO objective: Students will investigate ecological relationships present in biological and geological features of central Iowa.

Anticipated outcome: (concepts) There are characteristic environments each with characteristic life. Living things are adapted by structure and function to their environment. The creation of a satisfactory artifact that the student can display to classmates, parents, and friends.

Procedure: Fasten strip of cardboard into a circular collar using the paper clips or some other means to fasten the two ends together. Press this collar down around the track you wish to preserve.

Put powdered plaster of Paris into vegetable can and add water, a little at a time, stirring with a stick. When you have sufficient amount of batter the consistency of thick pudding pour into track, making sure that no air bubbles are left and that the mixture trickles into every corner of the track.

Let cast dry for 1 hour. Carefully remove collar and lift out the cast. Let dry for 1 or 2 more hours. Wash away all bits of soil and stones that cling to the cast and you will have a negative of the original track.

To make a positive grease the negative with vaseline, then press it into a second batch of soft plaster of Paris. When dried, life the cast out, and you will have a plaster of Paris copy of the original track. One may then paint this copy to make it appear more realistic.

If the air is very cold, casts can be made in snow by spraying the track with water from an atomizer. This will harden the track. As a further precaution against melting, mix some snow into the wet plaster. This will be a "negative" cast.

To make a "positive" cast, first coat the negative cast with vaseline, then set it in the paper collar and pour plaster mixture over it until the protuding paw mark is covered.

Materials needed: (Teacher's responsibility) Pencil, note book, a strip of cardboard 2" wide and one foot long, one used vegetable can, Plaster of Paris, water, paper clips.

Materials needed: (ECO responsibility) Iowa Conservation sheet of animal track identification.

Suggested evaluation: A show of the casts with identification, much like an art show. This could be judged, but would be more valuable as just a wildlife display.

COMMON IOWA WILDLIFE TRACKS

Topic: You in Your Environment Suggested Grade Level: 6 or 9 Locality: any area away from city lights (golf course) or 4-H camp

Activity or problem: Locating the North Star (Polaris).

Background needed: First two paragraphs of procedure.

Specific ECO objective: None

Anticipated outcome: (concepts). Universe is in constant change. The motion and path of celestial bodies are predictable. There are regular movements of the earth and stars. A method of locating 0° azimuth, and the initial step in opening the door to the greatest amateur science, Astronomy. Some understanding of the difference between true north and magnetic north.

Procedure: By means of blackboard sketches or other means show pupils the relationship of the "Big Dipper", the "Pointers", the North Star, and the "Little Dipper". Explain zenith and horizontal and that the angle between indicates altitude of star.

The North Star usually indicates true north within one degree error. At the present time the earth's axis points nearly exactly in direction of the North Star. This will not always be true, but for hundreds of years to come. It never rises nor sets, and is the only easily visible star that remains almost stationary in its position in the sky, day and night, summer and winter.

Have students measure the number of degrees difference between true north as indicated by the North Star and magnetic north as indicated by the compass.

Materials needed: (Teacher's responsibility) Pencil, note book.

Materials needed: (ECO responsbiility) Flashlight, compass.

Suggested evaluation: Have students locate North Star and the "Big Dipper".

Topic: Water Suggested Grade Level: 6 Locality: lake

Activity or problem: Wave motion.

Background needed: Ability to set up ratios and do comparisons.

Specific ECO objective: Students will investigate surface and subsurface water in a watershed that includes lakes, ponds, and streams.

Anticipated outcome: (concepts) Students will see that surface wave characteristics are dependent on: (1) wind speed, (2) wind direction, (3) fetch; that two factors of wave length are involved in a ratio of L/T.

Procedure: Students will conduct a survey of waves from the same location for several different hours. Note and record the wind speed for these hours as well as the fetch.

Determine wave length by gauging the distance from crest to crest against a known length such as a boat.

Determine the period by choosing an obvious feature such as a crest and measure length of time past a stationary point (bow of anchored boat).

Plot each hour's observation in table form comparing wave length, wind speed and fetch.

wavelength	wind speed and fetch

Determine height of wave crest in comparison to wave length against a given measure in increments of dm. or inches - express in ratio of H/L. (in theory a ratio of 1/7 will develop before the wave will break white caps . In nature, few waves are observed with values of 1/12 before breaking.)

Materials needed: (Teacher's responsibility) Pencil, note book, boat, or large float.

Materials needed: (ECO responsibility) Stop watch.

Suggested evaluation: Given one set of information such as wind speed and fetch, the student can theorize in generalized terms on wave lengths.

Topic: Water Suggested Grade Level: 6 Locality

Activity or problem: Evaporation in the water cycle.

Background needed: Ability to read instruments(wind, humidity, etc.) Ability to plot data on a graph. Some practice in making observations and coming to conclusions.

Specific ECO objective: Students will investigate surface and subsurface water in a watershed that includes lakes, ponds, and streams.

Anticipated outcome: (concepts) Students will observe that amount of evaporation is dependent on many factors and will be able to generalize on the amount of evaporation that will occur on a given day.

Procedure: Students will investigate evaporation rates in situations involving: 1) large surface area, shallow depth, 2) large surface area, deep depth, 3) small surface area, shallow depth, 4) small surface area, deep depth.

Determine the amount of evaporation each day against a given vertical measure and convert to a specific amount, e. g. cu. inches or millegrams.

Each day of the investigation, record: 1) the high and low temperature readings, 2) the relative humidity, 3) wind velocity, 4) any precipitation and amount, 5) any and type of cloud cover, 6) # of daylight vs. night time hours, 7) surface water temp. and air temp.

Plot data for each sample on separate sheets (or transparencies) and compare results, e. g. sample #1 will have 8 record sheets.

Small groups - each group do 1 sample. Long range - 3 weeks.

Do the investigation in several varying locations. Varying seasons. Continuing investigation over many seasons -- for comparison purposes.

Materials needed: (Teacher's responsibility) Pencil, note book, graph paper, containers.

Materials needed: (ECO responsibility) Maximum - minimum thermometers, hygrometer, anemometer, wind direction gauge.

Suggested evaluation: Performance tests.

Topic: Water Suggested Grade Level: 6 Locality:

Activity or problem: Effects of filtration on water.

Background needed: Ability to distinguish between sand, gravel, etc.

Specific ECO objective: While visiting a natural growth area and a cultivated area, students will conduct soil investigations.

Anticipated outcome: (concepts) Students will be able to evaluate the effectiveness of different methods of filtration.

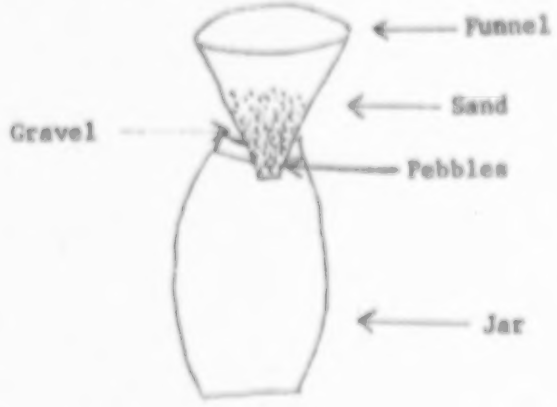
Procedure: Students will:

Collect jars full of water from a creek, stream, or lake which is muddy. (water has a high amount of suspended particles)

Put several jars aside to observe the way particles begin to settle.

With a funnel design methods of filtering the muddy water. Record methods and compare results. Students can collect substances from field area which can be used in filtering water such as small pebbles, gravel, sand, etc. Later such things as filter paper and cotton may be added to their supply of materials.

Students should make drawings of sediment layers.



Materials needed: (Teacher's responsibility) Pencil, note book, jars, filter paper, cotton.

Materials needed: (ECO responsibility) Funnel.

Suggested evaluation: Evaluate the drawings and ask students to explain what has taken place.

Topic: Water Suggested Grade level: 6 Locality:

Activity or problem: Stream motion.

Background needed: Ability to read a stop watch.

Specific ECO objective: Students will investigate surface and subsurface water in a watershed that includes lakes, ponds, and streams.

Anticipated outcome: (concepts) Students should see some relationship or correlation between stream velocity and water volume.

Procedure: Students will measure the velocity of a stream by:

Placing two sticks tall enough for top to stand above water and positioning sticks two meters apart. Toss a small rubber ball into the water upstream from the measuring station. Measure the time lapse as the ball passes between the two sticks. Record the data in meter/time.

Do the investigation in several locations: mainstream, stream edges, bend of the stream, rapids. Observe water depth at these locations. Record in "T" table, plotting position to rate of movement.

"T" table

place	
stream edge	1 m/10 sec.
mainstream	
↓	↓

Materials needed: (Teacher's responsibility) Pencil, note book.

Materials needed: (ECO responsibility) Poles, stop watch, meter sticks, rubber ball or ping pong ball.

Suggested evaluation: Problem solving test where students would correlate stream speed to location and depth.

Topic: Community Relationships Suggested Grade Level: 7 Locality: any woodland area

Activity or problem: Measurement of differences in climate under the crown and outside the crown of a tree.

Background needed: How to read a thermometer, light meter, sling psychrometer.

Specific ECO objective: Students will investigate the micro-climate relative to temperature, water availability and type of vegetation as determined by insolation.

Anticipated outcome: (concepts) Some understanding of how vegetation affects micro-climates.

Procedure: By interfering with rainfall and sunlight, leafy branches make the climate beneath the tree quite different from that in the open. Because some trees catch rain or shed snow, the area under the crown may be a local desert. Using the appropriate instruments investigate the climate under a maple, an elm, and a spruce or fir.

This investigation should be carried out during spring, fall, and winter.

Attempt to generalize this climate for a particular species to floor of a climax forest composed of this specie.

Further investigation should include radiation and frost patterns under species of trees.

Materials needed: (Teacher's responsibility) Pencil, note book.

Materials needed: (ECO responsibility) Thermometers, light meter, sling psychrometer.

Suggested evaluation: Discuss whether the student is aware of any seasonal change, and whether the shape of the tree has any effect.

Topic: Community Relationships Suggested Grade Level: 7 Locality: city park or lake area

Activity or problem: Draw up a food web after visiting a particular community and observing the evident kinds of life present.

Background needed: Food chains are made up of different species that have a feeding relationship - that is, each species is eaten by the next species in the chain. Plants, as you know, produce their own food through the process of photosynthesis. Then there are many kinds of animals that eat plants. These animals are called vegetarians or herbivores. The biologists call the plants, producers and the animals that eat the plants primary consumers. In addition, of course, there are many animals that eat the primary consumers. These are secondary consumers, and so on. Animals that eat only other animals are carnivores. Those that include both plants and animals in their diets are called omnivores. (You are an omnivore. If you ate only potatoes or carrots or spinach, you would be a primary consumer. If you ate only fried chicken, steak, or bacon, you would be a secondary consumer.) Finally, there are species of animals and plants that live on dead organisms. They are called by several names - such as scavengers or decomposers. Unlike carnivores and herbivores, they never catch their food alive. Many populations interacting through several different but connected food chains may be called a food web.

Specific ECO objective: Students will investigate the earth's crust in order to determine the effects of former environments on various ecological relationships.

Anticipated outcome: (concepts) The student will be able to distinguish the difference between a food chain and a food web. The student will examine interactions among organisms of different species.

Procedure: Make a list of the organisms evident under the appropriate heading of the charts below:

Land Environment

Producer	Primary Consumer	Secondary Consumer	Scavenger
1.	1.	1.	1.
2.	2.	2.	2.
3.	3.	3.	3.
4.	4.	4.	4.

(con't.)

Water Environment

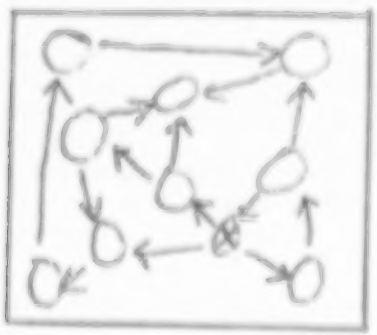
Producer	Primary Consumer	Secondary Consumer	Scavenger
1.	1.	1.	1.
2.	2.	2.	2.
3.	3.	3.	3.
4.	4.	4.	4.

Using a round object, draw 10 circles on a sheet of paper. Space the circles so they are randomly spaced. In each circle write the name of organisms from your list. Use the following numbers of organisms: 2 producers, 3 or 4 primary consumers, 3 or 4 secondary consumers, 1 scavenger.

Draw an arrow from each organism to every other organism that may depend upon it as a source of food. Some organisms may have several arrows pointing to and from themselves.

Draw an x through one of the circles meaning that all those species were removed from the arboretum. What life will lose a source of food then?

What life is less likely to be eaten because it is removed?



Materials needed: (Teacher's responsibility) Pencil, note book.

Materials needed: (ECO responsibility) Transportation and assistance.

Suggested evalulation: Through discussion analyze each other's observations. Given a list of producers and consumers the student will correctly draw up the possible food chain and food web.

Topic: Community Relationships Suggested Grade Level: 7 Locality: timber tract

Activity or problem: Find and observe rotting logs. Microsuccession.

Background needed: Knowledge in key usage.

Specific ECO objective: While visiting a timber tract, students will investigate the complexity of the interrelationships of life in a forest.

Anticipated outcome: (concepts) The student will identify the stages of decay and become aware of the varied quantity of life involved in the rotting processes.

Procedure: Succession from dead tree stage to where the log becomes part of the forest floor takes several years.

Stage I: Standing dead tree. Any bark on the tree? Is bark easily removed? Is wood hard and dry? Any invertebrates in bark or wood? Any wood borers? Any signs of invertebrates? Record. Any fungi?

Stage II: Newly fallen tree. Any bark? Is wood form, soft wet, or dry? Any invertebrates? Any borers? Record. Any fungi?

Stage III: Log rotting inside, but hard on outside. Lift off outer shell and examine contents. Break apart shell and note all invertebrates. Rake through punky part - look for invertebrates and vertebrates (lizards, snakes, salamanders). Any fungi?

Stage IV: Completely rotten log. Rake through rotten log, noting all species and quantities. Is wood more moist or less so than a previous stage. Any fungi?

In which stage were the most kinds of animals found? In which stage were the most animals of all species found? What is the most striking physical difference between the first and last stage? Any kind of life found in all four stages?

Chart on following page.

Materials needed: (Teacher's responsibility) Pencil, note book, small probing tools.

Materials needed: (ECO responsibility) Thermometers.

Suggested evaluation: The chart of observations prepared by the student will be examined.

	Stage I	Stage II	Stage III	Stage IV
Location				
Soil type				
Soil temp				
Air temp				
Rel humidity				
Veg. type				
Species				

Topic: Community Relationships Suggested Grade Level: 7 Locality:

Activity or problem: Collecting and storing algae on herbarium paper.

Background needed: Some work on identification. Palmer's "Field Book of Natural History" is an excellent guide for identification.

Specific ECO objective: Students will investigate the micro-climate relative to temperature, water availability and type of vegetation as determined by insolation.

Anticipated outcome: (concepts) Skill in collection and preservation of collected items. Interest in something they can keep. Depends whether collector is of elementary or secondary level.

Procedure: Fill pan with water. Completely submerge herbarium paper. Arrange the algae on the paper. A pin or pointed stylus may be used to arrange the algae. Can be done for either identification or decoration. When algae is arranged satisfactorily, slide paper with the algae on it out of the water. Place a piece of waxed paper directly upon the algae. Place this within a fold of a newspaper. Place a piece of blotting paper on each side of the newspaper. On the top and bottom place pieces of corrugated paper. Note: A number of specimens prepared as above may be pressed at same time. Place all under a cement block for a week.

Materials needed: (Teacher's responsibility) Pencil, note book, newspapers, waxed paper.

Materials needed: (ECO responsibility) 1 large pan, sheets of herbarium or index paper, blotting paper, weights.

Suggested evaluation: Examine finished product. What is a herbarium?

Topic: Community Relationships Suggested Grade Level: 7 Locality: lake area or marsh

Activity or problem: Field work in a grassland community.

Background needed: Some knowledge in: sampling techniques, observation skills, previous field study, use of identification keys.

Specific ECO objective: While visiting a grassland community, students will investigate the complexity of the interrelationships of life in a grassland.

Anticipated outcome: (concepts) The student will have investigated a grassland community to identify and know its distinguishing characteristics.

Procedure: Establish one or more quadrats one meter square, and count all the plants within the squares. Record on a quadrat data sheet (see enclosure). Observe the following:

a. Are the plants crowded together forming a compact sod, or is there open ground between clumps of grass?

b. Is there a great variation in plant types between wet and dry areas?

c. Are there any woody plants present?

Traps set out 24 hours previously may be examined for the day's catch. Identify the catch using a field guide key. Observe the following:

a. Are there any signs of mammals, such as scats, rabbit trails, or forms?

b. If any damp areas look for crayfish chimneys and presence of amphibians.

c. Sweep the vegetation for invertebrates and record the kinds and relative numbers caught.

Examine the nature of the soil and determine the pH. May make a soil profile. Take temp. of soil. Observe the following:

a. Is the soil dark or light brown, loam, sand, or clay?

b. Is the soil well-drained or not?

c. What is the depth of the top soil?

Three types of plants dominate the grassland communities: grasses, forbs, legumes. Identify and distinguish characteristics of each.

(con't.)

Materials needed: (Teacher's responsibility) Pencil, note book.

Materials needed: (ECO responsibility) Quadrat form, traps for small mammals, insect nets, pH paper, test tubes, thermometers.

Suggested evaluation: After field work has been completed, students will answer the following: 1) Is the community you studied a tall grass or short grass prairie? 2) What accounts for the depth and richness of the top soil? 3) Why are woody plants not typical prairie forms? 4) It is sometimes said that buffalo and fires set by Indians helped to maintain the prairie. Could you give any reason for agreeing or disagreeing with this statement?

QUADRAT DATA SHEET

STUDENT:_____ DATE:_____

Locality:_____ Vegetational type:_____

Soil type:_____ Depth of A horizon:_____ Soil pH_____

Soil temp:_____ Air temp:_____ Rel. humidity:_____

Quadrat No._____

Species	No.	% Area	Growth type*	Importance**

*Growth type: A = annual herb; P = perennial herb; S = shrub; T = tree.

**Importance: D = dominant; C = common; U = uncommon; R = rare

Topic: Community Relationships Suggested Grade Level: 7 Locality: any wooded area

Activity or problem: Identifying plant communities.

Background needed: Some knowledge of community relationships. Some discussion as to sampling techniques and the need to exercise care in sampling.

Specific ECO objective: Students will investigate the micro-climate relative to temperature, water availability and type of vegetation as determined by insolation. While visiting a natural growth area and a cultivated area, students will conduct soil investigations.

Anticipated outcome: (concepts) Awareness that the various sites or ecological niches provide different conditions for plant life and that these differences coincide with the requirements for life of the species involved.

Procedure: Record intensity of sunlight and temperature under the canopy of several community types.

Record relative humidity beneath canopy of the several community types (student teams take measurements at same time of day).

Obtain soil samples for each community and record wet weight in field and later obtain dry weight of same sample in laboratory.

Correlate the values obtained with producation values of the several communities. Prepare a narrative report on physical characteristics of the communities.

Materials needed: (Teacher's responsibility) Pencil, note book, graph paper,

Materials needed: (ECO responsibility) Photometer, sling psychrometer, triple beam balance, thermometers.

Suggested evaluation: Narrative reports will be evaluated by teacher.

Topic: Community Relationships Suggested Grade Level: 7 Locality:

Activity or problem: Interrelationship of producers and consumers from a pond community.

Background needed: Term and use of indicator dyes.

Specific ECO objective: While visiting a natural area, students will investigate the complexity of the interrelationships of life in it. Students will investigate surface and subsurface water in a watershed that includes lakes, ponds, and streams.

Anticipated outcome: (concepts) The student will know the function of light and the interdependence of plants and animals.

Procedure: Prepare 2 sets of 4 tubes and label A_1, A2, A_3, A_4, B_1, B_2, B3, B_4.

Pour pond water into each tube. Fill to within 20 mm. from the top. Add 3 to 5 drops of bromthymol blue solution to each tube. To each tube 1 add a small snail. To each tube 2 add a small snail and a sprig of a pond plant. To each tube 3 add a sprig of a pond plant only. To each tube 4 add only bromthymol blue. Place a cap on each tube and tighten.

Place tubes A_1, A_2, A_3, A_4, in strong light. Place tubes B_1, B_2, B_3, B_4, in a dark closet. Make observations on both culture series after 24 hours. Record any changes in the color of the indicator and in the condition of the plants and snails.

Then reverse the tubes - putting A_1, A_2, A_3, A_4, in the dark and B_1, B_2, B_3, B_4, in strong light.

Prepare a form for recording observations.

Materials needed: (Teacher's responsibility) Pencil, note book, sets of collecting bottles or culture tubes with screw cap.

Materials needed: (ECO responsibility) Glass marking pens, water snails, pond plants (preferably a leafy plant), bromthymol blue solution, pond water.

Suggested evaluation: The observations recorded by the students will be examined.

Topic: Community Relationships Suggested Grade Level: 7 Locality: timber tract

Activity or problem: Scat Analysis (determination of the ecological role of larger mammals and kinds of prey and the discovery of food web relationships).

Background needed: Previous introduction to predator/prey relationships. Be aware of the fact that some material is not digested and can be identified in fecal droppings.

Specific ECO objective: While visiting a timber tract, students will investigate the complexity of the interrelationships of life in a forest.

Anticipated outcome: (concepts) The student should become aware of some of the important predator/prey relations and of producer/consumer/predator/man relationships.

Precedure: Search the natural area for scats (fecal droppings) of the larger mammals and birds of prey (hawks and owls).

Record locations of finds on area map to assist in determining species habitat preference.

Scats may be collected in brown paper bags for more exacting laboratory analysis - or may be analyzed on site. Use a stick and crumble dry specimens.

Classification may consist of identifying the type of animal remains, but plant origin is sufficient for plant materials. Look for small mammal fur and bones, insects, bird bones and feathers, etc.

Prepare food chain identified in the form of a food web. Utilize data discovered in other activities to fill out food web information.

Materials needed: (Teacher's responsibility) Pencil, note book, collecting bags or paper sacks.

Materials needed: (ECO responsibility) None

Suggested evaluation: The student will have identified predator fecal scats and located preferred habitat of the species. The student will have identified the prey of the predator and established the predator's position in a single food chain in the larger food web. This information is recorded in field note books to be evaluated by the teacher.

Topic: Community Relationships Suggested Grade Level: 7 Locality:

Activity or problem: Investigating a marsh in the winter (or pothole, or pond).

Background needed: Some knowledge in: sampling techniques, observation skills, use of identification keys.

Specific ECO objective: While visiting a timber tract, students will investigate the complexity of the interrelationships of life in a forest.

Anticipated outcome: (concepts) The student will recognize the activity of a marsh community in the winter season and evaluate the environmental conditions involved for survival.

Procedure: Be sure it is safe ice conditions.

If safe ice conditions, run line transects. Identify plant species and zones of categories of plant growth. Record and describe old bird nests. Search for tracks and identify (esp. mink and raccoon). Watch for raptors in sky. Record life relationships. Open push ups around muskrat houses to see conditions. Search for prey remains. Search heavy cover for signs of activity and determine by what species. Develop report concerning life relationships in winter.

Materials needed: (Teacher's responsibility) Any track guide or field books available.

Materials needed: (ECO responsibility) Transect line.

Suggested evaluation: The reports will be examined by the teacher. Through follow-up discussion life activity of a marsh in winter time for survival will be discussed and important factors discovered by members will be listed.

Topic: Community Relationships Suggested Grade Level: 7 Locality: timber tract

Activity or problem: Compare understory characteristics of previously identified tree communities.

Background needed: Previous work on tree identification.

Specific ECO objective: While visiting a timber tract, students will investigate the complexity of the interrelationships of life in a forest.

Anticipated outcome: (concepts) Awareness of the effects of differing amounts of sunlight and moisture relationships caused by slope differences and the degree of openness of the canopy of dominant place.

Procedure: Set up random sample quadrats (6 to 8 in each comm. 1 square meter) per four students. Quadrats should sample each tree community for herbaceous understory cover and grass cover. Record numbers of stems or bunches of grasses, shrubs, and tree seedlings.

Each 4-students team sey up random sample plots (6-8 per team) of one square chain in each community to sample understory trees only. Record numbers of trees per plot.

Prepare bar graphs or histograms for the several communities to compare numbers of stems of herbaceous plants and grass cover per unit area, and numbers of understory trees per unit area. Prepare report.

Materials needed: (Teacher's responsibility) Pencil, note book.

Materials needed: (ECO responsibility) Quadrat frames, tape measure.

Suggested evaluation: The student will interpret bar graphs according to teacher's inquiry. Progress reports will be examined.

Topic: Community Relationships Suggested Grade Level: 7 Locality: timber tract

Activity or problem: Evidence of animal presence in woodland habitats and determination of habitats in use.

Background needed: Some experience in bird identification. Some previous work connected with fecal droppings.

Specific ECO objective: While visiting a timber tract, students will investigate the complexity of the interrelationships of life in a forest.

Anticipated outcome: (concepts) The student will have learned something about the way of life of woodland animals, about natural regulation of animal numbers, about the ecological role of several species.

Procedure: Search the bores and trunks of large wolf trees (mature hollow trees and snags) for indications that the tree is being used. If raccoon scats or hair are present, record on an area map as a raccoon den. If bark indicates smaller claw marks together with fine strands of hair, record as squirrel den.

Search mature trees with small squirrel size holes evident for signs of scratches, fur, food, remains and record as squirrel den homes.

Walk all trails for evidence of deer browsing. (Shrubs and tree twigs are nipped off with the pre-molars from the side. This leaves the tip fibrous rather than cleanly cut.) Record locations of browsing and also of droppings found on trail on area map to reveal habitat preferences and food habits. Record deer in proper place on food web diagram.

Record locations and identity of all birds flushed on the area map.

Prepare a report of your findings concerning food habits, preferred habitat, evidence of an edge effect, population levels, daily activity periods, and the relative security animals enjoy in their homes.

Materials needed: (Teacher's responsibility) Pencil, note book.

Materials needed: (ECO responsibility) Area map.

Suggested evaluation: A written report as called for in the procedure will be evaluated by project personnel.

Topic: Community Relationships Suggested Grade Level: 7 Locality: McFarland Lake

Activity or problem: Field work in a pond community. Take representative samples to set up a pond aquarium in the classroom.

Background needed: Some knowledge in: sampling techniques, observation skills, previous field studies, use of identification keys.

Specific ECO objective: While visiting a pond community students will investigate the complexity of the interrelationships of life in a pond.

Anticipated outcome: (concepts) The student will have investigated a pond community to identify and know its distinguishing characteristics.

Procedure: Obtain water samples from locations of the pond as directed by the teacher and use the water testing kit to determine oxygen and carbon dioxide concentrations and pH. Take temperature readings. Determine depth of water.

Collect plankton samples to be examined later in the lab.

Use dip nets to collect large invertebrates and seines for fish, amphibians, turtles. Note kinds and abundance of all animals found.

Use wire net scoops to strain organisms from mud bottoms and pond edge.

Make written observations in field notebook on plant life present, from the submerged aquatics in toward shore, from shoreline to vegetation around the pond. Note the dominant plants of each zone.

Take representative samplings of the plants and animals in the pond community to set up a pond aquarium in the classroom that may be studied to understand the balance of nature in a pond community.

Materials needed: (Teacher's responsibility) Pencil, note book, collecting containers.

Materials needed: (ECO responsibility) Hach chemical water testing kit, thermometers, plankton net, dip nets, seine, wire net scoops.

Suggested evaluation: The student will list, describe, or sketch the plants and animals observed in the pond community. Answer the following questions: Using a fresh-water key, what are the dominant plants of each zone? Would you call this a productive pond or not? Support your answer. The student will illustrate a pyramid of numbers to show he has gained information on plant-animal quantities for a balance of life.

Topic: Life Forms Suggested Grade Level: 7 Locality:

Activity or problem: Observe additional aspects of dispersal.

Background needed: The study of seed dispersal in plants, which generally comes at earlier grade levels, should be helpful.

Specific ECO objective: Students will observe conditions suggesting that adaptations for dispersing are necessary for all forms of life.

Anticipated outcome: (concepts) Students should conclude that although some species have strict limitations of movement, all have ways of dispersing.

Procedure: Several approaches are possible. One that seems promising is to divide a class into teams of several students. Send the teams out in various directions in a natural area, to locate examples of living things that lack a means of dispersal. If the students are critical, they may return with the conclusion that there are no such examples. When the teams reassemble and report their findings, the resulting interaction may take care of misconceptions. It is likely that the discussion will result in classifying dispersal methods. An obvious main grouping divides organisms that disperse under their own power and those that depend on outside agencies. The latter group may be subdivided according to the agency that aids dispersal: wind, water currents, other organisms. (Man should be included: he is a potent disperser of other species!)

The teacher should fill in with information only as a last resort. If aquatic organisms such as hydra or fishes are cited as having no way of moving from one pond to another the teacher may have to point out that wading birds such as the great blue heron may carry a hydra or fish eggs on its feet.

As a part of the actual field work, it may be helpful to examine examples of reproduction as a way of seeing the necessity for dispersal. At a muskrat den or a meadowlark nest, the importance of offspring moving into new territory - relieving population pressure in the home area - will be more vivid. In autumn students are likely to find spider webs floating in the breeze. Many such webs will have a young spider, being carried away from its home area. Bird droppings are a source of seeds that were carried from the parent plant. And various insects, marked with fast-drying dots of lacquer provide clues to the dispersal of these organisms.

Materials needed: (Teacher's responsibility) Pencil, note book.

Materials needed: (ECO responsibility) None.

Suggested evaluation: Student report.

Topic: Life Forms Suggested Grade Level: 7 Locality: weeded area

Activity or problem: Mosquito classification as to sex: ratio of male to female.

Background needed: Knowledge of insect parts: Proboscis, antennae, head, thorax, abdomen, wings, legs.

Specific ECO objective: Students will investigate the micro-climate relative to temperature, water availability and type of vegetation as determined by insolation.

Anticipated outcome: (concepts) An understanding of male and female role in preservation of species.

Procedure: 1. Male mosquito - plumed antennae
Female mosquito - very sparse antennae plumage

2. Set up table as to number of males to females per 15 minute period.

3. Average and compare for deviation during any one period.

4. Student should further investigate the role of the male mosquito.

A. Nectar meal
B. Doesn't bite animals including man.
C. Serves only to fertilize eggs.

Materials needed: (Teacher's responsibility) Pencil, note book.

Materials needed: (ECO responsibility) Magnifying glass or hand lens.

Suggested evaluation: Sex a collection of 5 mosquitos.

Topic: Life Forms Suggested Grade Level: 7 or higher Locality: Preston Branch and roadside areas

Activity or problem: Making a herbarium for a natural area.

Background needed: Some instruction in the collection techniques and instruction as to where things can be collected.

Specific ECO objective: While visiting a timber tract, students will investigate the complexity of the interrelationships of life in a forest.

Anticipated outcome: (concepts) The student will have learned to collect, identify, and preserve plant materials.

Procedure: In collecting plants it is desirable to have as many of the parts as is possible: roots, stems, leaves, flowers, and fruits. The plant may need to be bent in a V or N shape to fit mounting paper. The root may need to be cut longitudinally so as to less bulky for the press.

After collection of plant neatly arrange the parts and place it between blotting paper (newspapers).

When all of the plants collected are placed in blotting paper, stack between corrugated cardboard and put between a plant press. Let dry for 24 hours. The blotting paper may need to be changed 2 or more times. A week of drying should be sufficient.

It is important in making a collection to take notes regarding data, locality, habitat, height, color of flower, common name, etc. Use key.

After drying, mount the dried plant on mounting paper using Elmer's glue. Small strips of gummed tape may be used to securely affix stems, roots, etc.

After mounting in lower right-hand corner a label should identify the plant as to name, date, collector, and any other important information regarding the specimen.

Materials needed: (Teacher's responsibility) Pencil, note book, old newspapers, Elmer's glue, knife for each student or small group to cut stem with.

Materials needed: (ECO responsibility) Trowel, vasculum for collecting, plant press, corrugated cardboard, bloting paper, mounting paper 11½" x 16½".

Suggested evaluation: The student will have prepared a reference collection of plants which is the basis of the evaluation of the student.

Topic: Life Forms Suggested Grade Level: 7 Locality: any timber tract

Activity or problem: Student development of a method for measuring the height of a tree.

Background needed: Preliminary discussion of: earth's center of gravity, graphing, scaling.

Specific ECO objective: Provide these materials for the students and ask them to develop a method of measuring the height of a tree.

Anticipated outcome: (concepts) Student will be able to describe his environment in quantitative terms as to height.

Procedure: Assemble height-finder. Stand a measured distance from the base of the object that you intend to measure height of (ex. 30 ft.). Sight up the height-finder to the top of the object your're measuring (tree). Read the angle between 90° mark and plumb line. Develop a scale (ex. 5 ft. = 1") for distance measured in #2. Draw line D in figure B to scale on graph paper. Draw line H perpendicular to line d (angle C = 90°). Angle A is the angle measured between the 90° mark and plumb line. Extend line-of-sight line until it intersects line H. Measure line H according to scale and convert to ft. (ex. 5" = 5x5 = 25 ft. high). Add distance from ground up to person's eye. See drawing.

Materials needed: (Teacher's responsibility) Pencil, note book, protractor, string, lead sinker, stick, thumbtacks, graph paper.

Materials needed: (ECO responsibility) None

Suggested evaluation: Measure the height of some predetermined object.

Topic: Life Forms Suggested Grade Level: 7 Locality: wooded area

Activity or problem: Finding a bee tree.

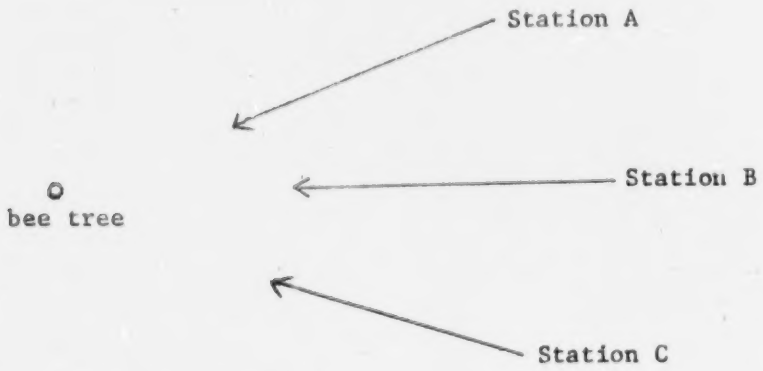
Background needed: This is a possible sequel to the experience of following a bee.

Specific ECO objective: While visiting a timber tract, students will investigate the complexity of the interrelationships of life in a forest.

Anticipated outcome: (concepts) A greater interest in the behavior of honey bees.

Procedure: Robbing honey bees by cutting down the bees' home tree was once a popular sport of woodmen. Finding the tree was part of the sport, and students can do this without being stung.

Near a forested area, place several dishes of syrup or honey at marked spots about a quarter of a mile apart. After foraging bees have located the food they will quickly load up and fly back to their home tree (or hive). Students mark the direction of flight from each of the food stations on a base map. If the bees are from the same colony, as is likely, the intersection of the flight lines will show the probable location of the tree.



Alternate procedure:

Another method, which some bee hunters regard as more sporting, requires only one feeding station. After bees are coming regularly to the dish, students will map the line of flight, then sprinkle a little flour on one of the foraging bees. They will check the time when the bee takes off and watch carefully for its return. Because honey bees fly at a reasonably uniform rate (about 400 yds/min) students will be able to calculate the approximate distance from the feeding station to the tree. Since the bee is likely to spend about 3 minutes in the hive, this should be deducted to determine the probable flight time.

It is of course possible to use a combination of the two procedures. Actually the students will need all the help they can find. The flight distance of honey bees may be as much as a couple of miles! If locating a bee tree were as easy as it sounds, woods-

men probably wouldn't have considered it a sport. Also, remember that the students may find a white hive in a farmer's orchard instead of a hollow basswood tree.

Materials needed: (Teacher's responsibility) Pencil, note book.

Materials needed: (ECO responsibility) Honey or syrup, white flour, wrist watch or timer.

Suggested evaluation: See if they can find a bee tree.

Topic: Life Forms Suggested Grade Level: 7 Locality: wooded area

Activity or problem: Mosquito collecting method using an aspirator.

Background needed: Production of an aspirator, mosquito as an insect.

Specific ECO objective: Students will investigate the micro-climate relative to temperature, water availability and type of vegetation as determined by insolation.

Anticipated outcome: (concepts) Proficiency in use of collecting device. Determination of optimum conditions for greatest mosquito activity. Treatment and interpretation of data.

Procedure: Student groups select various locations for collecting activity. (hill, valley, open, heavy vegetation) Record time, temperature, light, and wind readings every 15 minutes during collecting period. Record number of mosquitos caught during a 15 minute block of time. Note where caught. Plant, human, ground, etc.

Graph the results.
number caught vs. temperature
" " vs. light
" " vs. wind level
" " vs. location

Materials needed: (Teacher's responsibility) Pencil, note book, graph paper.

Materials needed: (ECO responsibility) Aspirator, storage container, killing jar, thermometer, light meter, anemometer, watch.

Suggested evaluation: Examination of notes and graphs.

Topic: Life Forms Suggested Grade Level: 7 Locality:

Activity or problem: Sounds significant to the season.

Background needed: A limited knowledge of life forms and their various ways of producing sound. Some knowledge of sound itself.

Specific ECO objective: Students will investigate the micro-climate relative to temperature, water availability and type of vegetation as determined by insolation.

Anticipated outcome: (concepts) A greater awarenes of the changing sounds of nature that we accept as background noise and most frequently ignore.

Procedure: Take students out on a sound investigating field trip. Do not provide them with prior information as to what sounds to expect other than the knowledge that certain seasonal sounds are indigenous to animal groups.

Have students stop at frequent intervals and attempt to locate and identify sounds heard. Note area sound seemed to come from consistently such as wooded area, waterways, cultivated fields, etc. Try to determine whether the sound producer indicates excitement, emotion, or merely monotonous regularity. Record time and temperature when sound is heard. If possible, select those sounds that would be heard during the day only.

Explain to the student about the snowy-tree cricket. It produces a monotonous repeated call which, if counted for 15 seconds and added to the number 37, gives the approximate temperature where the sound is produced. Have the students try this with rythmic sounds to see if there are other temperature correlations.

Arrange the group's information in tabular form and attempt to determine the dominant noise makers for a specific season.

Sounds significant to the season:

1. Spring sounds -- birds, frogs, and toads
2. Summer sounds -- birds, insects
3. Early-fall sounds -- insects
4. Late-fall sounds -- water birds and mammals
5. Winter -- relatively quiet

Materials needed: (Teacher's responsibility) Pencil, note book.

Materials needed: (ECO responsibility) Thermometer, watch.

Suggested evaluation: Check students' sounds for seasons against the teacher's list of sounds significant to the season.

Topic: Life Forms Suggested Grade Level: 7 Locality: wooded area

Activity or problem: Estimating board feet in a tree.

Background needed: Manipulation of formulas, Pi value, how to triangulate height.

Specific ECO objective: While visiting a timber tract, students will investigate the complexity of the interrelationships of life in a forest.

Anticipated outcome: (concepts) An understanding of how to figure the value of the lumber in a tree. Practical math exercise.

Procedure: Measure the girth (circumference) of a tree or its diameter. Use this information to figure the area of that circle. Measure the height of the usable trunk. Treat the tree trunk as a cylinder. There will be an error built in as the trunk tapers. The formula for cubic inches in that tree trunk is Vol = $R^2(H)$. There are 144 cu. in. in 1 board ft. Have students figure number of board feet in a tree. Providing you know the cost of lumber per board foot for that type of wood, one can figure the dollar and cents value.

Correlate with measurement of an acre. One could then count the trees of similar size and specie and roughly determine amount of lumber in that acre.

Materials needed: (Teacher's responsibility) Pencil, note book.

Materials needed: (ECO responsibility) Tape measure.

Suggested evaluation: Point out a tree and have the student work out the board feet in that tree.

Topic: Life Forms Suggested Grade Level: 7 Locality: area with flowers

Activity or problem: Following a honey bee.

Background needed: Honey bees feed on plant products, mainly from flowers. Their carbohydrate source is nectar, which bees convert to honey by evaporation of water and by chemical change in sugars. Their protein comes from pollen. In their harvesting operations bees aid in transferring pollen from one flower to another.

Specific ECO objective: While visiting a timber tract, students will investigate the complexity of the interrelationships of life in a forest.

Anticipated outcome: Students will find that any one bee tends to go from flower to flower of the same species, even though other kinds of flowers are nearby. It should be apparent that a bee would not contribute effectively to pollination if it frequently shifted species: Dandelion pollen doesn't work on clover; clover pollen doesn't work on honeysuckle.

Procedure: Students will locate a single honey bee and follow it from flower counting (a) the total number of plants visited, and (b) the number of kinds of plants visited. If the student happens to find a bee that has just arrived (with an empty storage stomach), the observation may last for a considerable time. If the bee is nearly loaded at the outset, the observation may be brief.

Students should be cautioned to be sure they are keeping track of a single bee.

Materials needed: (Teacher's responsibility) Pencil, note book.

Materials needed: (ECO responsibility) None

Suggested evaluation: Student group discussion.

Topic: Life Forms Suggested Grade Level: 7 Locality: timber tract

Activity or problem: Measuring forest productivity (saw-log production).

Background needed: Know the use of a Biltmore stick. Some experience with identification keys.

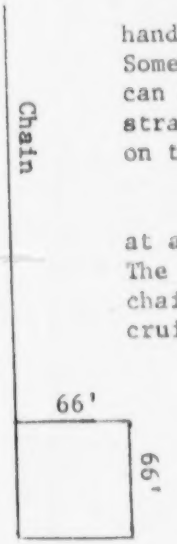
Specific ECO objective: While visiting a timber tract, students will investigate the complexity of the interrelationships of life in a forest.

Anticipated outcome: (concepts) The student will learn the skill of using a linear chain line to set up plots, the Biltmore stick for measurement of usable wood in tree, and to mathematically figure forest productivity.

Procedure: By selecting equally spaced plots along a chain line of one square chain, each student team will identify, measure with a Biltmore stick, count numbers of mature trees, and determine board feet production of plots and by proportion, production of the woodland.

A simple tool known as a crusier stick, (Biltmore stick), is a handy expedient for estimating the height and diameter of standing timber. Some State Extension foresters supply them through county agents, they can be purchased, or they can be homemade by graduating any straight straight stick (1 x 1 inch) to read in diameters on one side and heights on the other (Table 1 - see enclusure).

Commercially manufactured cruiser sticks are made to be read at a distance of 25 inches (assumed arm's length) from the observer. The measurements are usually made while standing at a distance of one chain (66 feet) from the tree. To make field measurements with your cruiser stick, use the following procedure:



1. Stand at a distance of one chain (66 feet) from the tree.
2. Hold your cruiser stick at arm's length with the long axis of the stick parallel with the long axis of the tree (figure 1 - see enclosure).
3. The merchantable height of the tree can be read directly from the stick. Be sure to allow for the stump!
4. Now move to the tree and read the diameter at a section breast high, holding the stick at arm's length.
5. If you wish to estimate the number of board feet in the tree, compare your measurements to Table 2 (see enclosure).

Materials needed: (Teacher's responsibility) Pencil, note book.

Materials needed: (ECO responsibility) Key to trees, chain, Biltmore stick, compass.

Suggested evaluation: The student will demonstrate the use of a Biltmore stick by using it to measure board feet in a mature tree for project personnel.

TABLE I. Markings for cruiser stick (25-inch reach).

Tree diameter (inches)	Mark on stick	Tree height (feet)	Mark on stick For 66 feet (1 diam.)
6	5 3/8	16	6 1/8
8	7	20	7 1/2
10	8 1/2	24	9 1/8
12	9 7/8	28	10 3/4
14	11 1/4	32	12 1/4
16	12 1/2	36	13 3/4
18	13 3/4	40	15 1/4
20	14 7/8	44	16 7/8
22	16	48	18 1/2
24	17 1/8	52	20
26	18 1/4	56	21 1/2
28	19 1/4	60	23 1/8
30	20 1/4		
32	21 1/8		
34	22 1/8		
36	23		
38	24		
40	24 3/4		

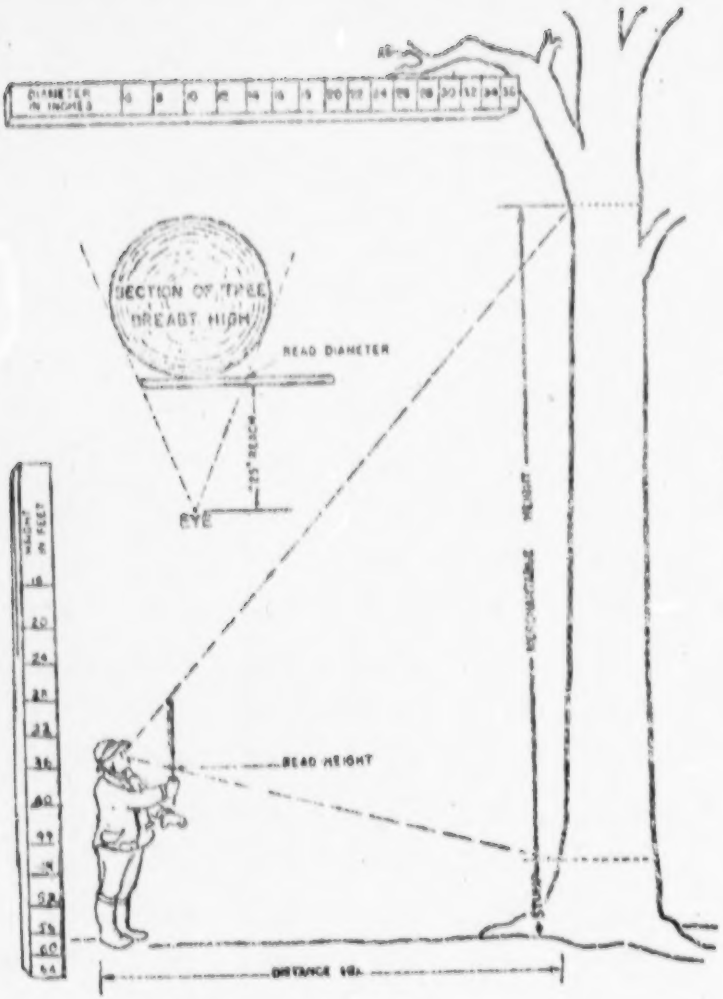


Fig. 1. Illustrating the use of a cruiser stick to measure diameters and heights of standing timber.[1]

TABLE 2. Number of board feet per tree.[1]

Tree diam. (in.)	Merchantable height in feet										
	16	24	32	40	48	56	64	72	80	88	96
	board feet										
10	36	48	59	66	73						
11	46	61	76	86	96						
12	56	74	92	106	120	128	137				
13	67	90	112	130	147	158	168				
14	78	105	132	153	174	187	200				
15	92	124	156	182	208	225	242				
16	106	143	180	210	241	263	285				
17	121	164	206	242	278	304	330				
18	136	184	233	274	314	344	374				
19	154	209	264	311	358	392	427				
20	171	234	296	348	401	440	480	511	541		
21	191	262	332	391	450	496	542	579	616		
22	211	290	368	434	500	552	603	647	601		
23	231	318	404	478	552	723	663	714	766		
24	251	346	441	523	605	664	723	782	840		
25	275	380	484	574	665	732	800	865	930		
26	299	414	528	626	725	801	877	949	1,021		
27	323	448	572	680	788	870	952	1,032	1,111		
28	347	482	616	733	850	938	1,027	1,114	1,201	1,280	1,358
29	375	521	667	794	920	1,016	1,112	1,210	1,308	1,398	1,488
30	403	560	718	854	991	1,094	1,198	1,306	1,415	1,517	1,619
31	432	602	772	921	1,070	1,184	1,299	1,412	1,526	1,640	1,754
32	462	644	826	988	1,149	1,274	1,400	1,518	1,637	1,762	1,888
33	492	686	880	1,053	1,226	1,360	1,495	1,622	1,750	1,888	2,026
34	521	728	934	1,119	1,304	1,447	1,509	1,727	1,864	2,014	2,163
35	555	776	998	1,196	1,394	1,548	1,702	1,851	2,000	2,156	2,312
36	589	826	1,063	1,274	1,485	1,650	1,814	1,974	2,135	2,298	2,461
37	622	873	1,124	1,351	1,578	1,752	1,926	2,099	2,272	2,444	2,616
38	656	921	1,186	1,428	1,670	1,854	2,038	2,224	2,410	2,590	2,771
39	694	976	1,258	1,514	1,769	1,968	2,166	2,359	2,552	2,744	2,937
40	731	1,030	1,329	1,598	1,868	2,081	2,294	2,494	2,693	2,898	3,103

TABLE 3. Average Height Growth of Hardwood Trees from Seed[2]

Kind	10 Years	20 Years	30 Years	50 Years
Ash, Green	26	41	52	70
White	19 - 25[1]	34 - 50[1]	45 - 67[1]	62 - 83[1]
Aspen	18 - 21	27 - 40	28 - 55	50 - 75
Basswood		16 - 32	23 - 44	37 - 63
Beech		8 - 19	13 - 28	22 - 42
Birch, Paper	13	30	44	62
Yellow[2]		30	18 - 39	15 - 54
Box elder[2]	20			
Catalpa, Hardy[2]	19	27	33	
Chestnut	7	17	33	64
Cottonwood[2]	56	37	115	136
Elm, White[2]		21	28	40
Eucalyptus[2]	24 - 80	70 - 90	85 - 160	
Gum, Red	35	66	88	108
Hickory, Shagbark	3 - 7	8 - 18	15 - 32	32 - 51
Locust, Black	15 - 20	28 - 45		44 - 65
Honey[2]	18	27	35	
Maple, Silver[2]	22	44	60	80
Sugar		18	29	40 - 48
Oak, Burr[2]			40	60
Red	13	32	46	72
White	11 - 12	22 - 25	32 - 38	53 - 63
Osage orange[2]		15 - 25	37	
Poplar, Yellow	20 - 27	36 - 50	50 - 64	78 - 83
Walnut, Black	18	30	40	60
Black[2]	50	73	89	109
Willow, White[2]	15 - 24	35 - 50		

[1]Where a range in height is given, the lower figure in each case is in poor growth situations.

[2]Plantation grown or grown under more favorable than average conditions. Others forest grown.

TABLE 4. Average Diameter Growth of Hardwood Trees[2]

Kinds	Average Number of years to grow one inch in diam.
Eucalyptus[1]	1/2 - 3
Cottonwood,[1] white willow,[1] honey locust,[1] black locust,[1] black willow	2 - 4
Silver maple,[1] white elm,[1] Russian mulberry,[1] hardy catalpa,[1] red gum, yellow poplar, chestnut	3 - 6
White ash,[1] green ash,[1] box elder,[1] black walnut,[1] butternut,[1] burr oak,[1] osage orange,[1] red oak, black oak, aspen, basswood	4 - 7
Hard maple,[1] hickory, white oak, chestnut, oak, paper birch, yellow birch, beech	5 - 10

[1]The growths of these trees were measured from plantation growth on farm lands, while the species not marked were grown in natural forests.

TABLE 5. Uses for Hardwoods[2]

Lumber	Veneer	Poles and Pots	Excelsior	Windbreaks	Barrels	Tool Handle Stock	Railroad Ties and Mine Timbers	Hardware Distilation
Ash	Basswood	Catalpa	Aspen	Green ash	Ash	Ash	Black locust	Beech
Basswood	Beech	Coffee tree	Basswood	Box elder	Basswood	Beech	Honey locust	Black birch
Beech	Yellow birch	Red elm	Cottonwood	Cottonwood	Beech	Birch	Red oak	Yellow maple
Birch	Black cherry	Eucalyptus	Willow	Eucalyptus	White elm	Sugar maple		
Black cherry	Sugar maple	Black locust	Yellow poplar	Hackberry	Sugar maple	Sugar maple		
White elm	Oaks	Honey locust		Silver Maple	White oak	White oak		
Hickory	Red gum	Russian mulberry		Russian mulberry				
Sugar maple	Sycamore			Osage orange				
Oaks	Black walnut	Oaks		Russian olive				
Red gum	Yellow poplar	Osage orange		White willow				
Black walnut		White willow		Yellow willow				

Topic: Life Forms Suggested Grade Level: 7 Locality: stream or pond

Activity or problem: Behavior of crayfish in relation to its structure and environment.

Background needed: Should have some knowledge of body parts.

Specific ECO objective: Students will investigate surface and subsurface water in a watershed that includes lakes, ponds, and streams.

Anticipated outcome: (concepts) The student will identify the body structural parts to determine its behavior and classification.

Procedure: Take a field trip to an area that includes a stream where crayfish may be found. Observe their activities in water. Catch some for study. Put in a small water tank containing stones and sand. How does the crab walk? Describe the structure of the body. Pick up the crayfish by the middle so as to avoid the claws. Put it down away from stone. Where does the crab go? Does it have antennae? Antennules? Look at its eyes. How are they built and used? Feel the shell. Describe. Why is the term crustacean appropriate? Note the color. How is this coloration useful? Examine the appendages. Explain the name arthropod for the phylum of the crayfish. After observations return crayfish to the stream.

Materials needed: (Teacher's responsibility) Pencil, note book.

Materials needed: (ECO responsibility) Nets, holding tank.

Suggested evaluation: On a drawing of a crayfish identify the parts and tell their function. Use a phylum key for classification.

Topic: Life Forms Suggested Grade Level: 7 Locality: timber

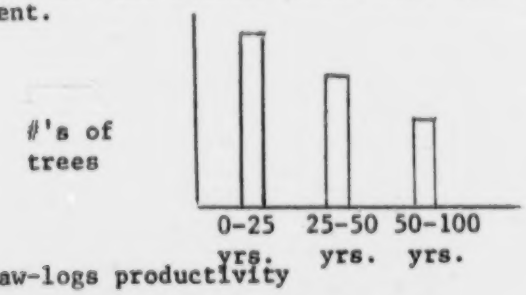
Activity or problem: Aging a tree and determining approximate age of maturity.

Background needed: None

Specific ECO objective: While visiting a timber tract, students will investigate the complexity of the interrelationships of life in a forest.

Anticipated outcome: (concepts) The student will acquire the skill of using an increment borer to age a tree.

Procedure: Student teams will select different tree communities. Each team will use increment borer and count annual rings of the dominant marketable species. Each team will prepare a frequency graph or histogram for each species which also indicates age at which tree rot is present.



Saw-logs productivity

Utilizing data from aging and total board feet woodland production from previous field labs, determine annual forest productivity for each species together with its market value and determine the cutting cycle in years approximate for each of species.

Materials needed: (Teacher's responsibility) Pencil, note book, graph paper.

Materials needed: (ECO responsibility) Increment borer, sealout for hole.

Suggested evaluation: The student will age a tree in presence of project personnel.

Topic: Life Forms Suggested Grade Level: 7 Locality: woodland area

Activity or problem: Find and observe ways seeds are naturally dispersed.

Background needed: None

Specific ECO objective: While visiting a timber tract, students will investigate the complexity of the interrelationships of life in a forest.

Anticipated outcome: (concepts) The student should recognize that nature has supplied many and various methods for seed dispersal based upon the shape of the seed unit.

Procedure: Display the following objects:

a small parachute (air born)
a fish hook (attachment)
a popgun with a cork (force)
a toy boat (floating)
a maple seed
a mature dandelion flower
a beggar tick plant

Identify the objects and see the relationship between them.

Look for seeds in the area to group according to their methods of dispersal.

Observations:

What does a seed require to grow?
Why don't all the seeds produced by a plant grow?
What would happen if all the seeds simply dropped beneath the parent plant?
Which method offers the widest scattering?
Why can't man depend on nature's dispersal of seeds?

Materials needed: (Teacher's responsibility) Pencil, note book.

Materials needed: (ECO responsibility) None.

Suggested evaluation: The seed groupings will be discussed with and examined by the teacher. Given a gorup of seeds by the teacher the student will examine them and then group according to dispersal methods.

Topic: Life Forms Suggested Grade Level: 7 Locality: pond or stream

Activity or problem: Sampling free-living water bacteria and other organisms.

Background needed: Some previous exposure to microscopes, instructed that care must be exercised in collection techniques.

Specific ECO objective: Students will investigate surface and subsurface water in a watershed that includes lakes, ponds, and streams.

Anticipated outcome: (concepts) The student will study water for bacteria. An understanding of water pollution will hopefully result from this.

Procedure: Clean two microscope slides as follows: Scrub with green soap or Bon-Ami. Dip them in acid-alcohol for one minute and dry with tissue. Place them in a beaker of distilled water for five minutes to allow any residual solvent to dissipate.

Tape a piece of wire to one edge. Hold the slides back to back by their edges. Do not touch the flat surfaces with your fingers. Wrap all four edges with tape. For identification attach a gummed label with your name to the wire.

Suspend the slide in a stream, pool, river backwater, lake, or woodland pond. Leave for a minumum of 4 hours or up to a week. Slides may be suspended at varying depths.

Remove the binding from the slides. Prepare one slide with Gram's stain and place a drop of distilled water and coverglass on the other one.

Examine both slides under microscope and record observations.

Classify where possible or identify types by use of a simple key.

Materials needed: (Teacher's responsibility) Pencil, note book, adhesive tape, gummed labels.

Materials needed: (ECO responsibility) Microscope slides, acid-alcohol, distilled water.

Suggested evalulation: Using the simple bacteria key, identify the bacteria for teacher. The student will use key to identify prepared slides provided by the teacher to show that he knows the skill of using a bacteria key.

Topic: Soil Suggested Grade Level: 7 Locality: timber tract

Activity or problem: Survey of soil invertebrate organisms under the different tree communities.

Background needed: Some knowledge of key usage, some knowledge of sampling techniques.

Specific ECO objective: While visiting a natural growth area and a cultivated area, students will conduct soil investigations.

Anticipated outcome: (concpets) Numbers and kinds of organisms are seen to be related to the amount of organic matter present except in stream bottoms where organic matter has been transported rather than created on site.

Procedure: Establish a quadrat in each identified tree community of one square meter. Clear all of the duff or debris and clip all of the ground cover and remove (pick a quadrat that has no trees or heavy brush). Pour potassium permanganate solution evenly over the square meter area. Classify the organisms which come to the surface and record numbers. Compare numbers and kinds of organisms found in each community soil type.

Materials needed: (Teacher's responsibility) Pencil, note book, collecting jars.

Materials needed: (ECO responsibility) Scissors, quadrat form, several gallons of potassium permanganate solution.

Suggested evaluation: Student reports and classification of organisms will be examined. Data can be correlated with similar surveys made in grass communities.

Topic: Soils Suggested Grade Level: 7 & 9 Locality: any area with gravel

Activity or problem: Gravel and soil comparison - soil organic materials.

Background needed: Must be able to operate a balance scale and burner. Some knowledge of what is a rock and what makes a soil.

Specific ECO objective: While visiting a natural growth and cultivated area, students will conduct soil investigations.

Anticipated outcome: (concepts) Students will recognize water loss. Student may recognize humus as being present in soil. Something besides minerals is necessary for plant growth.

Procedure: Collect equal weights of gravel and a soil. Compare as to color, particle size, etc. Plant growth. Heat samples red-hot in a crucible for 15 minutes. Weigh both samples after treatment. Record any change from initial weight. Compare weight changes. Theorize as to what causes the comparative difference in weight loss.

Materials needed: (Teacher's responsibility) Pencil, note book.

Materials needed: (ECO responsibility) Balance, scale, propane burner, matches, crucible, ring stand.

Suggested evaluation: Examination of their theories as to what is missing from gravel to soil.

Topic: Soils Suggested Grade Level: 7 Locality:

Activity or problem: Look at some kinds of micro-organisms and invertebrates that live in the soil

Background needed: Soil consists of rock materials, water, dissolved chemical substances, decaying organic matter, and a rich assortment of microorganisms and orther plants and animals. Thus the soil constitutes an important type of ecological community. Rhizobium is a genus of soil bacteria which lives symbiotically with legume plants in the nodules. The bacteria fix nitrogen gas - that is, they convert the gas into usuable soluble nitrates.

Specific ECO objective: While visiting a natural growth area and a cultivated area, students will conduct soil investigations.

Anticipated outcome: (concepts) Living things are inter-dependent with one another and with their environment. The student will observe the variety and quantity of life in the soil, both visible and invisible.

Procedure: Preparation. On a field trip collect small samples of fertile soil. Dig up a whole clover plant (including roots with the nodules). Scrape off the vegetation of 1 sq. meter soil so bare soil is exposed.

Visible soil organism. Pour the potassium permanganate over the exposed bare soil. Watch for living organisms to come to surface. Collect organisms in collection bottles to take back to lab to identify and analyze.

Soil cultures. Flame a transfer loop. Use it to streak some fertile soil on surface of cornmeal agar in petri dish. Shake up a pinch of the same soil in sterile water. Transfer five drops of the soil suspension to a petri dish of dextrose agar, and spread by gently swirling the dish. Incubate both dishes at room temperature for one week. One week later examine petri dishes with naked eye, and microscope. Identify the types of organisms found.

Nitrogen - fixing bacteria (Rhizobium bacteria). Remove a nodule from a clover plant. Place between 2 slides and crush with a slight grinding motion. Fix the smears in the flame; stain 30 seconds with carbol fuchsin; wash 2 minutes in water; blot dry. Examine the smears under the microscope. Find and draw the bacteria. Compare a prepared Rhizobium slide with your own.

Materials needed: (Teacher's responsibility) Pencil, note book, collecting bags, petri dish of cornmeal agar, petri dish of dextrose agar, sample of fertile soil, sterile water, clover plant, microscope, burner, transfer loop, slides, carbol fuchsin stain.

Materials needed: (ECO responsibility) Collecting tools, potassium permanganate solution.

Suggested evaluation: Students reports of invertebrates identified and drawings of bacteria will be evaluated.

Topic: You and Your Environment Suggested Grade Level: 7 Locality: timber tract

Activity or problem: Location of communities of trees on a woodland site.

Background needed: Knowledge of key usage, what is meant by dominants and sub-dominants.

Specific ECO objective: While visiting a timber tract, students will investigate the complexity of the interrelationships of life in a forest.

Anticipated outcome: (concepts) Students will discover that a tree species usually occurs in aggregates associated with certain other tree species and that this aggregation is a community.

Procedure: Students will be divided into four groups. They will employ their tree keys and identify dominants and sub-dominants on four sides in a woodland: ridges of upland, north slopes, south slopes, valley floors (or stream bottoms).

Students will draw in areas of the various communities on the map.

Materials needed: (Teacher's responsibility) Pencil, note book.

Materials needed: (ECO responsibility) Reproduced maps of area.

Suggested evaluation: Students should be able to name and recognize the principal or dominant species in a community.

Topic: Air Suggested Grade Level: 8 Locality: Brookside Park

Activity or Problem: Investigating campsite possibilities.

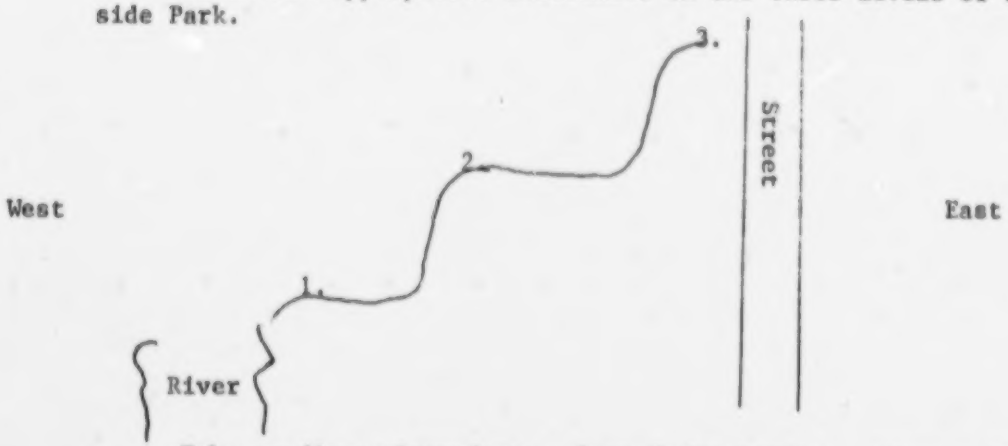
Background needed: Knowledge that man's understanding of his environment is enhanced through use of instruments that extend the capabilities of his five senses. These instruments allow man to quantify his environment as opposed to saying it is damp, windy, and warm.

Secific ECO objective: Students will investigate the micro-climate relative to temperature, water availability and type of vegetation as determined by insolation.

Anticipated outcome: The student will develop skills in the use of instruments and the treatment of data.

Procedure: Air pressure -
Anemometer -
Humidity -
Temperature - Air temp. (Celsius or Fahrenheit scale)
Light meter - foot candles

Place the appropriate instrument on the three levels of Brookside Park.



Take readings throughout a 1 or 3 day period. Average the readings for each time period. Make a bar graph for each set of data. (Note season of the year).

One could collect the temperature data in C and change it to F. $C = 5/9(F-32)$ or $C = \frac{F-32}{1.8}$ $F = 9/5C + 32$ or $F = (1.8)(C) + 32$

Correlated labs:

1. Soil Temperatures
2. Soil Moisture
3. Soil pH
4. Soil Texture and Structure
5. Plant Survey

Materials needed: (Teacher's responsibility) Graph paper, pencil.

Materials needed: (FCO responsibility) Barometer, anemometer, hygrometer,

(con't.)

thermometer, light meter.

Suggested evaluation:
1. Inspection of graphs produced.
2. Testing as to proficiency in reading instruments as set up in four stations in the lab.

Topic: Camera Techniques Suggested Grade Level: 8 up Locality: any open area

Activity or problem: Developing camera skills: effect of angle in "stopping" motion.

Background needed: General understanding of shutter speed.

Specific ECO objective: None.

Anticipated outcome: (concepts) The student should improve his judgment of the shutter speed required for sharp pictures that involve various angles of movement.

Procedure: The shutter speed required for sharp definition of objects in motion depends on the angle of movement. An object approaching the camera head-on can be photographed at relatively show shutter speeds in relation to the speed of the subject. A much faster shutter speed would be required for the same object moving at right angles to the camer's line of sight.

The student should photograph (at the same shutter speed) an object (a boy running at top speed, for example) directly toward the camera, again at 45°angle, and again at 90°.

Materials needed: (Teacher's responsibility) Pencil, note book, student's personal camera if available.

Materials needed: (ECO responsibility) Camera, black-and-white film.

Suggested evaluation: Pupil-teacher discussion covering the finished pictures.

Topic: Camera Techniques Suggested Grade Level: 8 Locality: away from city lights

Activity or problem: Constellations and moon photography.

Background needed: Basic knowledge of operation of a camera.

Specific ECO objective: None.

Anticipated outcome: (concepts) The universe is in constant change. Light energy can be converted to chemical energy. Increased proficiency and understanding in operation of the camera.

Procedure: Constellations - Black - and - White - It takes an extremely high-speed film and a special camera to photograph individual constellations. The film is Polaroid 3000 and the camera is the Polaroid Land camera that permits time exposures.

Set up the camera for taking star trails photo, but aim it at the constellation you desire to photograph. Use the black cardboard in front of the lens while opening the shutter. Expose for 30 seconds. Replace cardboard and close the shutter. Then, for extra contrast, develop two to four times the length of the usual development time - that is 30 to 60 seconds instead of 15 seconds at 70 F, 2 minutes or more at 35 F, and etc.

Constellations - color shots of the constellations taken with highest-speed color film are very spectacular in showing the different colors of various stars: red, Betalgeuse; bluish-white, Vega; yellow, Capella; golden, Albireo. Due to the slow speed of color films, these shots have to be taken in the form of star trails, at 10 to 20 minute time exposures.

Moon - The moon is unsatisfactory unless shot with a telephoto lens. When shooting the moon in black-and-white, use a medium-fast film and increase the contrast with a yellow filter over the lens. When using color, do not shoot beyond 1 second; at slower speeds the moon will have moved so much that a blurred picture results.

For a sequence of the phases of the moon, start by taking several shots of the full moon to determine the proper exposure. Then, after the next new moon, shoot the other phases, increasing the exposure ten times for crescent moon, five times for first quarter, and two times for the gibbous phase.

Materials needed: (Teacher's responsibility) Pencil, notebook, student's camera if available.

Materials needed: (ECO responsibility) Polaroid Land camera and film, 35mm camera and film, filters, cardboard.

Suggested evaluation: Discussion of the results, inspection of the pictures produced.

Topic: Water Suggested Grade Level: 8 Locality: lake

Activity or problem: Investigating light penetration of snow & ice.

Background needed: Some knowledge of the following terms: photosynthesis, light, opaque, transluscent, and transparent materials.

Specific ECO objective: Students will investigate surface and subsurface water in a watershed that includes lakes, ponds, and streams.

Anticipated outcome: (concepts) Some knowledge of opaque materials. Perhaps some idea whether life clusters in areas during winter months.

Procedure: Cut ice from several points on a lake. Measure its thickness and capacity for transmitting light. Examine water below each place where ice has been removed for varying kinds of life. Prepare a table of your data in terms of candle power. Does photosynthesis take place during winter?

Actually winter water takes O_2 from the air, and so open water is more necessary to the level of O_2 in the water than photosynthesis.

Materials needed: (Teacher's responsibility) Pencil, note book, black cloth or paper.

Materials needed: (ECO responsibility) Ice saw, meter sticks, light meter.

Suggested evaluation: Have the student discuss the following question: Does the thickness of the ice or the apparent opaque cover have the greatest affect upon light penetration?

Topic: Fossils Suggested Grade level: 9 Locality: Preston's Branch

Activity or problem: Fossil collection, cleaning and identification.

Background needed: Student should know that fossils are generally associated with sedimentary rock. Student should know something about method of deposition of sedimentary rocks. Student should know how to use a picture key of fossils.

ECO objective: Students will investigate the earth's crust in order to determine the efects of former environments on various ecological relationships.

Anticipated outcome: (concepts) There are characteristic environments, each with their characteristic life. The student should understand that certain types of fossils are found in certain types of rock. From the rock type they might try to determine the environment. The environment of living things is in constant change.

Procedure: Collection of the fossil by digging, trading, or picking up from the surface. If the fossils are collected from different horizons the horizon should be noted. Each fossil type should be placed in a separate container or have one container for each horizon. Upon return to the classroom the student should carefully clean the fossil, in most cases just wetting the fossil and using an old tooth brush would be sufficient. In some cases a weak acid such as vinegar may be used. The student should then attempt to identify the fossil.

Materials needed: (Teacher's responsibility) Note book, pencil.

Materials needed: (ECO responsibility) Picture keys for area, picks, brushes and collecting bags.

Suggested evaluation: Evaluate the specimen according to degree of cleaning done and accuracy of identification.

Topic: Soils Suggested Grade Level: 7 & 9 Locality: any area with gravel

Activity or problem: Gravel and soil comparison - soil organic materials.

Background needed: Must be able to operate a balance scale and burner. Some knowledge of what is a rock and what makes a soil.

Specific ECO objective: While visiting a natural growth and cultivated area, students will conduct soil investigations.

Anticipated outcome: (concepts) Students will recognize water loss. Student may recognize humus as being present in soil. Something besides minerals is necessary for plant growth.

Procedure: Collect equal weights of gravel and a soil. Compare as to color, particle size, etc. Plant growth. Heat samples red-hot in a crucible for 15 minutes. Weigh both samples after treatment. Record any change from initial weight. Compare weight changes. Theorize as to what causes the comparative difference in weight loss.

Materials needed: (Teacher's responsibility) Pencil, note book.

Materials needed: (ECO responsibility) Balance, scale, propane burner, matches, crucible, ring stand.

Suggested evaluation: Examination of their theories as to what is missing from gravel to soil.

Topic: Soil Suggested Grade Level: 5-7-9 Locality: timber tract

Activity or problem: Recreate soil profiles from soil samples taken from each tree community.

Background needed: Some instruction on proper sampling techniques.

Specific ECO objective: While visiting a natural growth area and a cultivated area, students will conduct soil investigations.

Anticipated outcome: (concepts) Awareness that decaying organic matter from different sites and from different communities build different kinds of soil from the same parent material.

Procedure: Take sample borings from each community. Keep the borings separated from each horizon. Measure the depth of each horizon. Recreate in the laboratory a profile which maintains the correct proportions of each horizon for each community. Students may work in teams. Save profiles for comparisons with soil types from other biomes such as grasslands.

Materials needed: (Teacher's responsibility) Pencil, note book, paper bags for soil samples.

Materials needed: (ECO responsibility) Soil borer.

Suggested evaluation: Recreated soil profiles will be examined.

Topic: Soil Suggested Grade Level: 5-9 Locality: selected road cut

Activity or problem: Visit to a road cut to study erosion effects.

Background needed: Vocabulary: slump, creep, landslide, colluvium, texture, boulders.

Specific ECO objective: Students will investigate the earth's crust in order to determine the effects of former environments on various ecological relationships.

Anticipated outcome: (concepts) The student should see: that the angle of slope will govern the type and amount of erosion, that plant type will retard erosion to various degrees, that soil type will effect rate of erosion, that removal of colluvium changes slope, that deposition occurs upon contact with larger body of water.

Procedure: Look for effects of a recent or prolonged rain on the soil.

Has there been formation of gullies?

Is there any evidence of slump, creep, or landslide?

Does the removal of colluvium aid in any slump or creep activity?

Can you trace the path of the soil from the road cut to a nearby stream?

What happens to the soil as it reaches the stream?

Make a list of some of the things that retard erosion.

What is the texture of the soil?

Has man attempted to retard erosion?

Materials needed: (Teacher's responsibility) Pencil, note book.

Materials needed: (ECO responsibility) Picks, shovels.

Suggested evaluation: Supply the student with an hypothetical situation and have them draw conclusions and suggest activities to retard erosion. Hypothesize as to origin of the soil.

Topic: Soils Suggested Grade Level: 9 or special class Locality:

Activity or problem: Preparation of a contour map.

Background needed: The student should be able to: (1) read and interpret a prepared contour map, (2) read a compass, (3) make use of proportions, (4) make accurate measurements, (5) understand relief shading, (6) know what a benchmark is and how they are used.

Specific ECO objective: Students will investigate the earth's crust in order to determine the effects of former environments on various ecological relationships.

Anticipated outcome: (concepts) A completed map that another person could use to locate any permanent feature, hill or major topographic change.

Procedure: A small area will be mapped using steel tape, hand transit, compass, and drawing materials.

Students will learn to set up and use the transit-level in running their transect lines, marking out boundries and mapping the area.

The student will use a field compass to geographically orient the map.

The student will determine the contour interval to be used on the map.

The student will include on the map permanent features of the area that would be of value to someone else using the map.

Materials needed: (Teacher's responsibility) Pencil, note book, drawing materials.

Materials needed: (ECO responsibility) Steel tape, hand transit, compass, magnetic.

Suggested evaluation: Have a scavenger hunt using this map as the guide for locating certain points where a specific object has been placed.

ACTIVITY - THE CONSTRUCTION OF A CONTOUR MAP Name_____

The distribution of plants, animals, rocks, and other environmental factors may be more completely understood by creating a topographic or contour map of an area.

The following guide describes the procedure we will use to map a small area while on this ECO field trip.

- - - - - - - -

The class will be divided into groups of 5. Each group will collect data, and with the combined data from all the groups, we will construct a contour map.

EQUIPMENT FOR EACH GROUP

Clipboard, compass, range pole, sighting device (with crosshairs), marking stakes, hammer, and a measuring tape or measuring rope.

PROCEDURE

1. All groups will start at the top of the hill and work outward from a common starting point in their assigned compass direction. Your instructor will assign your group a compass direction.

2. Record your groups compass direction. Use your compass and determine the direction towards which you will work. You might locate a distant rock or tree, and proceed in the direction of that rock or tree as you work. This would eliminate the need for continuous compass readings.

3. To start, the person with the sighting device will remain at the top of the hill. The person with the range pole will proceed away from the hilltop in his groups assigned direction until it is determined that the elevation has dropped 4 feet.

4. The person with the range pole marks the spot.

5. Two members of the group must then measure the horizontal distance from the sighting device to the range pole. RECORD THIS DISTANCE.

6. Now bring the sighting device down the hill to the newly marked spot. The person with the range pole will again move further down the hill in his groups assigned direction until it is determined that the elevation has dropped another 4 feet. Like before, measure and record the horizontal distance.

7. Proceed down the hill repeating the above process until you reach a previously arranged stopping point.

8. If you observe any objects such as rocks or trees you deem important enough to be shown on the map, make a note of them as you work. Such objects would have to be on your 'path' or very close to it.

- - - - - - - -

BRIEFLY - When your group returns to the ECO trailer to plot your data, you must be able to provide:

(a) Your groups assigned compass direction.
(b) The horizontal distances between each measured elevation change of 4 feet.

STREAM PROFILES

The construction of a stream profile can be accomplished with the improvised equipment illustrated in the preceding pages. To determine the profile work in teams of at least two:

1. Select a sighting device which complies with your desired interval. The apparatus illustrated in figures 3 and 5 is adequate for this purpose.

2. Have your partner mark the spot where the line-of-sight intersects the bank upstream (figure 3).

3. Measure the distance from your location to that of your teammate.

4. The measurement recorded is the distance the stream travels before it decends an amount equivalent to your interval.

5. Move upstream to your helper and have him mark the next intersection point upstream. Repeat the above until the desired length for the stream profile has been recorded. The distance between the marks becomes the "x" axis and the "y" is equivalent to your interval marker.

Topic: Soil Suggested Grade Level: 9 Locality: Preston Branch, Soper's Mill

Activity or problem: Preparing a cross-section of a river valley.

Background needed: Some previous work on mapping and constructing cross-sections.

Specific ECO objective: Students will investigate surface and subsurface water in a watershed that includes lakes, ponds, and streams.

Anticipated outcome: (concepts) The student should be able to see from his cross-sections that the walls of the valley have their slope controlled by the stream.

Procedure: Facing upstream, draw a cross-section of the valley at the places indicated by your instructor.

Location #1

Location #2

Location #3

Materials needed: (Teacher's responsibility) Pencil, note book.

Materials needed: (ECO responsibility) Measuring tapes.

Suggested evaluation: Look at finished profiles.

Topic: Soil Suggested Grade Level: 9 Locality: Preston Branch, Soper's Mill

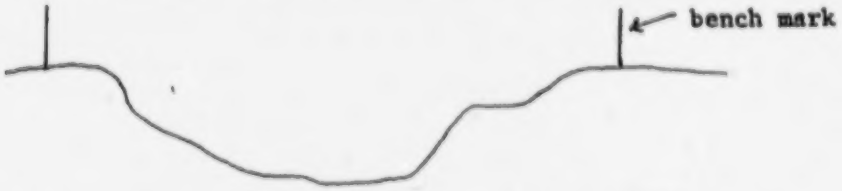
Activity or problem: Mapping a small gully or washway.

Background needed: How to collect data, how to plot information on graphs.

Specific ECO objective: Students will investigate the earth's crust in order to determine the effects of former environments on various ecological relationships.

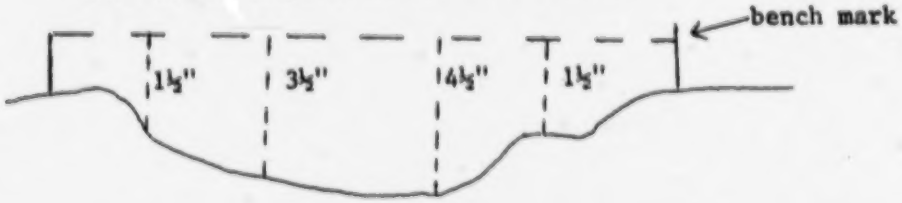
Anticipated outcome: (concepts) If students did this over a period of time, erosion evidence could be gathered which might indicate the do's and don'ts of good conservation practices.

Procedure: Select a small gully which is just beginning to become eroded and place bench marks along edges as shown.



Be sure to place bench marks well in the ground and well back from the edge of the gully.

Pull a wire from one bench mark to the other and mark off, with white crayon, in one foot intervals.



Students will measure down from the wire to the ground at the individual intervals and record the measurements.

Upon return to class students will plot measurements on a graph which will suggest the cross-sectional view of the gully.

Materials needed: (Teacher's responsibility) Pencil, note book, graph paper.

Materials needed: (ECO responsibility) Long stakes (bench mark), wire, plumb lines, meter sticks.

Suggested evaluation: Give the students some data and see if they could make a plot of a gully and make interpretations regarding kinds of conditions which contribute to erosion.

Topic: Soil Suggested Grade Level: 9 Locality: city park

Activity or problem: Infiltration of water into various types of soil located in similar topographic regions.

Background needed: Be able to measure a given volume of water accurately. Be able to time accurately.

Specific ECO objective: While visiting a natural growth area and a cultivated area, students will conduct soil investigations.

Anticipated outcome: (concepts) The student should recognize that even though the topographic expression is the same you may get different rates of infiltration because of soil type.

Procedure: The student will locate several areas that are in similar topographic regions and test for infiltration rate. The student should at least be able to find sandy soil, top soil, gravel and possibly various thicknesses of top soil.

Materials needed: (Teacher's responsibility) Pencil, note book, uniform cans with both ends removed, 1 can for each 2 students.

Materials needed: (ECO responsibility) Timing device.

Suggested evaluation: Students should be able to offer some logical explanatations for the variance in infiltration rates. This could be handled in group discussion, teacher-pupil discussion or a brief lab write-up.

Topic: You in Your Environment Suggested Grade Level: 9 Locality: any area away from city lights (golf course)

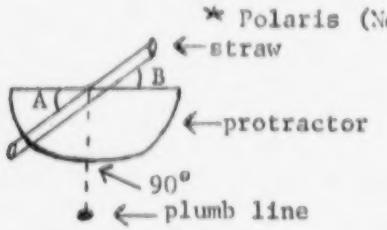
Activity or problem: Finding the latitude of your location.

Background needed: Ability to locate North Star (Polaris). An understanding of how a student's zenith and a horizontal extension from his eye will form a 90 degree angle. How to read a protractor and make a plumb line.

Specific ECO objective: None.

Anticipated outcome: (concepts) The universe is in constant change. The motion and path of celestial bodies are predictable. Increased understanding of latitude and man's need to orient and locate himself and things within his environment by various methods.

Procedure: Assemble your equipment and form an instrument to read the angle for the altitude of the North Star.



Sight the star through the straw, making sure the plumb line runs through 90° on the protractor.

Angle A is equal to angle B. Therefore, the number of degrees one reads from the protractor for altitude reading is the same as your present approximate latitude.

1. What would this angle be if you were standing on the North Pole?

2. What would this angle be if you were standing on the equator?

Materials needed: (Teacher's responsibility) Pencil, note book, protractor, straw, string, lead sinker, thumbtacks.

Materials needed: (ECO responsibility) Flashlight, camera.

Suggested evaluation: Check student's angle readings and compare to actual latitude.

Topic: You in Your Environment Suggested Grade Level: 9 up Locality: McFarland Lake or Izaak Walton

Activity or problem: Preparation of a bathymetric contour map.

Background needed: The student should have completed the activity connected with the preparation of a contour map.

Specific ECO objective: Students will investigate surface and subsurface water in a watershed that includes lakes, ponds, and streams.

Anticipated outcome: (concepts) The map should be used to show how the topography of the area is continued beneath the water surface.

Procedure: A lake will be mapped to show the underwater terrain. The limits of the lake will be mapped according to the procedures given in the contour mapping activity. After the outline of the lake has been determine depth soundings will be taken using line and weight. Care must be given to insure proper location of the sounding. Contour lines will be constructed form the various readings.

Materials needed: (Teacher's responsibility) Pencil, note book.

Materials needed: (ECO responsibility) Steel tape, hand transit, compass, drawing materials, line and weight, boat and equipment.

Suggested evaluation: Student should be able to predict temperature variation, current, depositional regions, and locate areas on the lake that would have certain depths.

Topic: You in Your Environment Suggested Grade Level: 6 or 9 Locality: any area away from city lights (golf course) or 4-H camp

Activity or problem: Locating the North Star (Polaris).

Background needed: First two paragraphs of procedure.

Specific ECO objective: None

Anticipated outcome: (concepts) Universe is in constant change. The motion and path of celestial bodies are predictable. There are regular movements of the earth and stars. A method of locating 0° azimuth, and the initial step in opening the door to the greatest amateur science, Astronomy. Some understanding of the difference between true north and magnetic north.

Procedure: By means of blackboard sketches or other means show pupils the relationship of the "Big Dipper", the "Pointers", the North Star, and the "Little Dipper". Explain zenith and horizontal and that the angle between indicates altitude of star.

The North Star usually indicates true north within one degree error. At the present time the earth's axis points nearly exactly in direction of the North Star. This will not always be true, but for hundreds of years to come. It never rises nor sets, and is the only easily visible star that remains almost stationary in its portion in the sky, day and night, summer and winter.

Have students measure the number of degrees difference between true north as indicated by the North Star and magnetic north as indicated by the compass.

Materials needed: (Teacher's responsibility) Pencil, note book.

Materials needed: (ECO responsbiility) Flashlight, compass.

Suggested evaluation: Have students locate North Star and the "Big Dipper".

Topic: Water Suggested Grade Level: 3-5-7-9 Locality: any snowbank

Activity or problem: Exploring a snowbank

Background needed: Study of light, spectrum, energy, conversion of light to heat.

Specific ECO objective: Students will invstigate the micro-climate relative to temperature, water availability and type of vegetation as determined by insolation.

Anticipated outcome: (concpets) Depending upon background, the student should arrive at some conclusion about light absorption in relation to the spectrum of visible light. Light to heat.

Procedure: Explore the snowbank with a thermometer to see what the temperature reading are at the top, middle, and bottom, just under the surface of the snow on the sunny side and shade side. Compare these temperatures with the air temperature.

Place 3 colors of construction paper on the sunny side of the snowbank along with a plain white paper. Place thermometer on snow surface just under paper. Check and record temperatures every five minutes for 20 to 30 minutes. Make a line graph of temperature vs. time. If time permits repeat process for shady side of snowbank.

Materials needed: (Teacher's responsibility) Pencil, note book, black, red, white, and green construction paper.

Materials needed: (ECO responsibility) Thermometer, light meter.

Suggested evaluation: Discuss the following statement and defend ideas: Which would absorb energy more rapidly - a dirty or clean snowbank?

Topic: Water Suggested Grade Level: 9 up Locality: Preston Branch, Ledges

Activity or problem: Investigating the volume of a stream. To determine the volume of water (in cubic meters/second) that passes a given point along a small stream.

Background needed: Some degree of proficiency in measuring to the near-nearest 0.1m. Be able to find area and volume.

Specific ECO objective: Students will investigate surface and subsurface water in a watershed that includes lakes, ponds, and streams.

Anticipated outcome: (concepts) A loss or gain of energy effects molecular motion. Volume of flow affects amount of material suspended. Volume is related to velocity as well as cross-sectional area.

Procedure: A. To determine the cross-sectional area of the stream.

1. Choose a point along the stream that is free from brush, trees, etc., in order that you can make your measurements accurately and yet with some degree of ease.
2. With a meter stick, measure the diameter of the stream and record in meters correct to the nearest .1m. (For instance, 3.6m) _____
3. Using a meter stick, measure the depth of the stream in 4 different places, at equal intervals, across the stream. _____, _____, _____, _____, (nearest .1m)
4. Determine an average depth by adding the four depths you just recorded and dividing by four. _____ (nearest .1m)
5. To determine the cross-sectional area of the stream, multiply the width by the average depth. _____

B. To determine the velocity.

1. Move upstream a few paces and drop a cork into the water. Measure the distance in meters (to the nearest .1m) that the cork floats in 10 seconds. _____ To determine how far it floats in 1 second divide by 10. _____ Repeat this procedure three times and determine an average. Each time, throw the cork in a different place in regard to how far from the bank it lands. (Note: is there a difference in velocity at different points in the stream?) Show your average velocity per second here. _____

C. To determine the volume in cubic meters per second.

1. Multiply the cross-sectional area (procedureA) times the velocity (procedureB). Your answer should be in cubic meters per second. _____

Materials needed: (Teacher's responsibility) Pencil, note book, graph paper.

Materials needed: (ECO responsibility) Tape, corks, meter stick.

(con't.)

Suggested evaluation: Construct graph showing results at several stations. Theoretically all volumes should be the same for a given section of of the stream.

Topic: Water Suggested Grade Level: 9 up Locality: McFarland Lake, Izaak Walton, Hickory Grove, Don Williams

Activity or problem: Determining the proportion of suspended particles in a body of water - at intervals - following a rainfall.

Background needed: Student should be able to make accurate volume measurements, be able to use a balance accurately, be able to figure proportions.

Specific ECO objective: Students will investigate surface and subsurface water in a watershed that includes lakes, ponds, and streams.

Anticipated outcome: (concepts) The student would be able to recognize that rainfall has an effect on the amount of suspended particles.

Procedure: Obtain water samples at various locations. Take a measured volume and determine mass. Evaporate the water and find the weight of the residue. Determine the proportion of residue to water. Plot the results of the various locations against each other. Plot the results of the various intervals at each location against each other.

Materials needed: (Teacher's responsibility) Pencil, note book.

Materials needed: (ECO responsibility) Containers for uniform volume, balance, graph paper, heat source, pyrex beaker, filter paper, centrifuge.

Suggested evaluation: The student should be able to draw conclusions from the graphs completed.

Topic: Water Suggested Grade Level: 9 Locality: any area

Activity or problem: Exploring a snowbank.

Background needed: Some knowledge of packing, insulation, altitude of the sun.

Specific ECO objective: Students will investigate surface and subsurface water in a watershed that includes lakes, ponds, and streams.

Anticipated outcome: (concepts) A change in the state of matter is determined by molecular motion. Matter exists as solids, liquids, and gases. Temperature and pressure effect the state of matter.

Procedure: Take temperature at various depths in the snowbank. Observe variation in crystals for the different depths. Compare the melting of the snow at different locations. Take light meter readings at various locations. (dirty area, clean area, close to a tree, wind-swept, etc.) Stand in a road that runs east and west and observe any difference between the south and north sides. Stand in a road that runs north and south and compare the east and west banks.

Materials needed: (Teacher's responsibility) Pencil, note book, graph paper.

Materials needed: (ECO responsibility) Light meter, magnifying glass.

Suggested evaluation: Have the student return to the classroom and prepare and interpret graphs showing recorded temperature differences.

PROJECT ECO

SLIDES

Tray #1 1st grade group at Innis Grove, September, 1971

1-1	1st grade from Harlan loading up to go to Innis Grove.
1-2	1st grade getting into bus.
1-3	Just after departure from bus - 1st grade.
1-4	Orientation before nature hike.
1-5	Comparing broadleaf forms.
1-6	Gathering around for look at poison ivy.
1-7	Mr. Dunn telling group about poison ivy.
1-8	Group looking around for mole tunnels.
1-9	Group looking around for animal homes in general.
1-10	Small group probing for mole tunnels.
1-11	Two children probing for mole tunnél.
1-12	Two children probing for mole tunnel.
1-13	One child probing at the mole tunnel.
1-14	Recess time at el Shafto.
1-15	Recess time at el Shafto.
1-16	Two children standing in front of el Shafto.
1-17	Getting ready for work on leaf study.
1-18	Group receiving work materials for leaf study.
1-19	Three children in shelter house at Innis Grove doing leaf study.
1-20	Boy spraying leaf.
1-21	Mr. Dunn removing leaf from board.
1-22	Another boy spraying leaf.
1-23	Mr. Dunn helping boy pin leaf on board.
1-24	Girl making comparison of spatter paint leaf and impression painting.
1-25	Finished product of several forms.
1-26	Some materials used in leaf study.
1-27	Mr. Dunn making comparison of leaves.
1-28	Mr. Dunn making comparison of leaves.
1-29	Recess at the fort.

Tray #1 (continued)

1-30 Recess at the fort.

1-31 Recess at the fort.

1-32 Recess at the fort.

1-33 Boys in Indian teepee.

1-34 Boys in Indian teepee.

1-35 Boys in Indian teepee.

1-36 Group waving good-bye from Innis Grove.

Tray #2 1st grade group at McFarland Lake

2-1 Two boys with two-man saw.

2-2 A group working on two-man saw.

2-3 A group working on two-man saw.

2-4 Boy working with one-man saw.

2-5 Group around Indian long house.

2-6 Indian long house.

2-7 Indian long house.

2-8 Inside of Indian long house.

2-9 Just outside of Indian long house.

2-10 Girl sitting on log.

2-11 Three boys in boat.

2-12 Three boys in boat.

2-13 Three boys in boat.

2-14 Three boys in boat.

2-15 Three boys in boat.

2-16 Three boys in boat.

2-17 Three boys in boat.

2-18 Group gathering around for lunch.

2-19 Group climbing hill up from long house.

2-20 Closeup of group climbing hill up from long house.

2-21 Group looking at material used to study sun movement.

2-22 Mr. Dunn showing group picture from polaroid camera.

2-23 Distant view of fishermen.

2-24 Distant view of fishermen.

2-25 Closer view of fishermen.

2-26 Closeup of boy and bass.

2-27 Closeup of boy and bass.

2-28 Group along lake fishing.

2-29 Wheelchair boy fishing.

Tray #2 (continued)

2-30 Two boys fishing.

2-31 Small group fishing.

2-32 Small group and teacher fishing.

2-33 Small group fishing.

2-34 Three boys fishing.

2-35 Small group gathered around to listen to nature story.

2-36 Group in front of ECO trailer getting read to go home.

Tray #3 3rd grade group at Izaak Walton Park, Fall, 1971.

3-1 Group in distance with raincoats on.

3-2 Teacher talking to group with raincoats on.

3-3 Instructor talking to group with raincoats on.

3-4 Teacher with umbrella and group with raincoats ready to go to the lake.

3-5 Instructor with group of students with raincoats on.

3-6 Small group starting out for the lake with raincoats on.

3-7 Small group at the lake making collections.

3-8 Group by the lake making collections.

3-9 Small group at the lake making collections.

3-10 Small group at the lake collecting samples.

3-11 Small group at the lake collecting samples.

3-12 One girl taking net from water.

3-13 Small group collecting at lake.

3-14 Three girls collecting at lake.

3-15 Small group collecting at lake.

3-16 Small group collecting at lake.

3-17 Small group collecting at lake.

3-18 Small group collecting at lake.

3rd grade group at Hickory Grove, Winter, 1971.

3-19 Boy bringing back stump to study tree rings.

3-20 Two kids going off over the hill.

3-21 Two boys working two-man saw.

3-22 Boy looking over the lake with binoculars. Lake has ice on it.

3-23 Teacher in trailer with students.

3-24 Teacher in trailer with students.

3-25 Small group by side of bank at Beaver Dam.

3-26 Entire group with instructor by the Beaver Dam.

Tray #4 5th grade students at 4-H camp, Fall (September), 1971.

4-1 One fifth grade class in front of the lodge where we worked.

4-2 Instructor and teacher with snake showing it to two children.

4-3 Small group working at the table.

4-4 Small group working at the table.

4-5 Small group working at the table around Mr. Dunn.

4-6 Small group studying shale bank.

4-7 View of group studying shale.

4-8 One student taking water sample.

4-9 Group of 7 or 8 climbing up shale bank.

4-10 Group of 7 or 8 climbing up shale bank.

5th grade students at McFarland Lake, Winter, 1971.

4-11 Sign - McFarland Lake.

4-12 Dedication stone - McFarland Lake.

4-13 Boy with one-man saw cutting tree for tree rings.

4-14 Boys digging in the side of hill for rocks from the till.

4-15 Two boys using saw.

4-16 Distant view of girl drawing.

4-17 Closer view of girl drawing.

4-18 Closeup of girl drawing.

4-19 Group walking across dam.

4-20 Small group walking along in the snow.

4-21 View of group working in the snow.

4-22 ECO trailer sitting in the snow.

4-23 Distant view of ECO trailer sitting in snow.

4-24 Couple of boys working on long house.

4-25 Mr. Dunn looking for water sampler.

4-26 Overall view of gravel pit.

4-27 Girl handing rock to Mr. Frazier.

4-28 Mr. Frazier cutting rock in saw.

Tray #4 (continued)

4-29 Mr. Frazier giving sawed rock back to girl.

5th grade students at Pleasant Grove Cemetery, Winter, 1971.

4-30 One boy making tombstone rubbing.

4-31 Two boys making tombstone rubbing.

4-32 Finished view of two boys' tombstone rubbing.

4-33 Two boys making tombstone rubbings.

4-34 5th grade teacher and students in snow making tombstone rubbings.

4-35 Associate teacher and students in snow making tombstone rubbings.

Tray#5 The following slides are of 7th grade activities at Preston Branch, October, 1971.

5-2 7th grade boys testing temperature of water.

5-3 7th grade group on hillside at Preston Branch.

5-4 Two girls on their quadrangle - Preston Branch.

5-5 Two boys sanding water in the creek.

5-6 Two girls on hillside looking for fossils.

5-7 Group on hillside looking for fossils.

5-8 Two people working in the quadrangle.

5-9 7th grade teacher looking at equipment in ECO trailer.

5-10 7th grade teacher coming down steps of ECO trailer.

5-11 Blank.

The following slides take place at Hickory Grove, January, 1972.

5-12 Boy cutting hole in ice.

5-13 A group around boy cutting hole in ice.

5-14 Boy cutting hole in the ice.

5-15 Two boys cutting hole in the ice.

5-16 Two boys cutting hole in the ice.

5-17 Group of girls cutting hole in the ice.

5-18 Group of girls cutting hole in the ice.

5-19 One girl cutting hole in the ice.

5-20 Girl lowering Secchi disk to get indication of turbidity.

5-21 Plankton net crew.

5-22 Water analysis crew.

5-23 Water analysis crew.

5-24 Plankton net crew in foreground, transect group in background.

5-25 Transect group on ice.

5-26 Transect group on ice.

5-27 Distant view of ice hole for pulling gill net through.

5-28 Plague Iowa State University Fishery Research tied to end of net.

Tray #5 (continued)

5-29 Plague Iowa State University Fishery Research tied to end of net.

5-30 Chopping hole in the ice.

5-31 Group chopping hole in the ice.

5-32 Instructor telling about what the net looks like and how it is used.

5-33 Pulling the net out, taking out bullhead.

Tray #6 9th grade group at the Ledges State Park, January, 1972.

6-1	Group going up side of hill to make contour lines.
6-2	Group working on contour lines.
6-3	Group working on contouring.
6-4	Small group on contouring.
6-5	Small group on contouring.
6-6	One boy looking through sighting staff.
6-7	Boy looking through sighting staff.
6-8	Boy looking through sighting staff.
6-9	Boy looking through sighting staff with girl looking on.
6-10	One crew showing completion with the rod crew closest to the camera.
6-11	The same crew with boy looking through sighting staff.
6-12	Girl looking through sighting staff.
6-13	Boy holding rod.
6-14	Girl looking through sighting staff.
6-15	Group sliding down the hill.
6-16	Same group sliding down the hill in snow.
6-17	Student measuring from the sighting staff to the rod.
6-18	Girl looking through sighting staff.
6-19	Girl looking through sighting staff.
6-20	Two people standing with the sighting rod.
6-21	Mr. Dunn taking pictures of crew.
6-22	Group from Central with sighting staff and rod.
6-23	Sighting rod.
6-24	Small group going up side of hill and contouring.
6-25	Group going up side of hill and contouring.
6-26	Two groups going up side of hill and contouring.
6-27	Group going up side of hill and contouring; shows sighting staff and rod man.
6-28	Fallen victim getting up.

Tray #6 (continued)

6-29 A girl holding rod.

6-30 A girl sighting through sighting staff.

6-31 Boy getting ready to sight through sighting staff.

6-32 Instructor by side of river asking for interpretation of why you have open water at this point when the rest of the river is frozen over.

6-33 Class looking at tree on the corner at the Ledges that illustrates the height that Saylorville Dam flood waters will be.

6-34 Group sitting in snow listening to instructor. The discussion is about the sandstone formation at the Ledges.

6-35 Group trudging through the snow.

6-36 Whole group up against sandstone formation just before returning to schoo

Tray #7 9th grade - First part at the Ledges, 1972 and Second part Fall, 1971.

7-1 Shows group in trailer warming up after they have been working on their contour lines.

7-2 Girls plotting data that she got when measuring contour intervals.

7-3 Group of 4 relaxing as they have finished their gathering of data.

7-4 Girl plotting data received during contour study.

7-5 Shelter house at the Ledges State Park.

7-6 Sandstone cliff at the Ledges illustrating concretions and interface.

7-7 Cliff at the Ledges illustrating differential weathering.

7-8 Cliff at the Ledges showing where a concretion had fallen out leaving a small cave.

7-9 Landslide debris at the Ledges.

7-10 Slide illustrating cross-bedding at the Ledges.

7-11 Concretion in stream beds.

7-12 Shows undercutting of sandstone ledge by present day stream.

7-13 Stream widening by mass wasting.

7-14 Sandstone cliff with interface midway in the cliff.

7-15 Blank.

7-16 Boys sitting on side of hill at Soper's Mill.

7-17 Group of 9th graders on delta - Skunk River.

7-18 Group studying rock structure on side of tributary - Soper's Mill.

7-19 Group up on the side of the hill studying the rock outcropping.

7-20 Group on side of the hill studying rock outcropping.

7-21 Telephoto of group on hill studying rock outcropping.

7-22 Two girls on side of the hill studying rock outcropping.

7-23 Small group studying rock outcropping.

7-24 Small group on delta - Skunk River.

7-25 Small group on delta - Skunk River.

7-26 Small group of girls studying rock outcrop.

7-27 One girl climbing up side of hill to study rock outcrop.

Tray #7 (continued)

7-28 Small group studying rock outcrops.

7-29 Small group on the delta - Skunk River.

7-30 One boy on side of the hill studying rock outcrop.

7-31 Small group studying delta.

7-32 Two boys on the delta looking at the shape of rocks.

7-33 Four girls on delta looking at the shape of rocks.

7-34 Boys looking at plant life in the vicinity of Soper's Mill.

7-35 Girl on side of the hill looking at rock outcrops.

7-36 Small group on side of the hill looking at rock outcrops.

Tray #8 Wind damage after storm of Fall, 1971.

8-1 Whole tree uprooted and tipped over.

8-2 Tree along sidewalk indicating that the tree broke off at a diseased area.

8-3 A tree that has been snapped about 5 or 6 feet above ground level.

8-4 A large tree with one limb broken off.

8-5 Another large tree with a limb broken off.

8-6 How a tree was broken off about 8 feet up; tree appears to be about 18 inches in diameter.

8-7 Mr. Dunn pointing out imperfections within the tree or in the area of breakage.

8-8 Smaller tree uprooted.

8-9 Large maple tree that was completely uprooted.

8-10 Tree snapped off about 12-14 feet from ground level indicating break at area where insects have damaged the tree.

Tray #9 Various activities of Project ECO

9-1 Roger Spratt in the field.

9-2 Mr. Dunn and group cooking breakfast at Pilot Knob State Park.

9-3 Group activity in afternoon at Pilot Knob State Park.

9-4 Group of students and Mr. Dunn cooking breakfast at Pilot Knob State Park.

9-5 Distant view of Pilot Knob Lake from tower at Pilot Knob.

9-6 Intermediate view of Pilot Knob at Pilot Knob State Park.

9-7 Telephoto of Pilot Knob Lake at Pilot Knob State Park.

9-8 Creeping jenny on side of tree.

9-9 Poison ivy on the ground.

9-10 Poison ivy on the side of a tree.

9-11 Poison ivy with berries on the ground.

9-12 Poison ivy on the side of a tree.

9-13 Yellow fungus on side of a tree at 4-H camp.

9-14 Yellow fungus on side of a tree at 4-H camp.

9-15 One of the prairie plants at the high school.

9-16 High school prairie plant.

9-17 High school prairie plant is the helianthus.

9-18 Lead plant at the prairie.

9-19 One of the grasses of the high school prairie.

9-20 False indigo plant, high school prairie.

9-21 One of the plants on the prairie.

9-22 Prairie plant.

9-23 Prairie plant.

9-24 Group of plants on the prairie.

9-25 Black sampson, high school prairie.

9-26 Group of black sampsons.

Tray #9 (continued)

9-27 Closeup of black sampson.

9-28 Black sampsons on the side of the prairie.

9-29 Group of yellow plants on the prairie.

9-30 One of the anemones on the prairie.

Tray #25 General slides dealing with ECO

25-1 Description of Project ECO - Title slide.

25-2 Description of Project ECO - Title slide.

25-3 Iowa outline map showing Story County.

25-4 Iowa outline map showing Story County.

25-5 Map of Story County.

25-6 Map of Fellows School.

25-7 Dr. Kiser and Jerry Dunn at Preston Branch.

25-8 Dr. Kiser and Jerry Dunn at Preston Branch.

25-9 Four boys erecting sign at Preston Branch.

25-10 Group of teachers watching Mr. Dunn on one activity.

25-11 Group of teachers watching Mr. Dunn on one activity.

25-12 Closeup of Mr. Dunn pouring laytex in ant hole.

25-13 Group of people at Fellows gathered around one of the plantings.

25-14 Group of people at Fellows gathered around the doorway.

25-15 Group of people at Fellows gathered around a planting.

25-16 View of trailer before rennovation started.

25-17 View of trailer with studing on wall.

25-18 Early stages of remodeling.

25-19 Early stages of remodeling of trailer.

25-20 Front part of trailer being fit with furnace.

25-21 Outside of trailer as its first coat of paint is applied. No signs or anything else are on trailer.

25-22 Interior of trailer during cabinet hanging stages.

25-23 Blank.

25-24 Interior of trailer showing some microscopes and finished interior.

25-25 Interior of trailer showing microscopes and finished interior.

25-26 Interior of trailer showing microscopes.

25-27 Interior of the trailer showing the sink.

Tray #25 (continued)

25-28 Interior of trailer showing the refrigerator.

25-29 Interior of trailer showing radio system.

25-30 Closed view of trailer from the rear at Preston Branch.

25-31 Closed view of trailer from side sitting at Preston Branch.

25-32 Open view of trailer from side at Preston Branch.

25-33 Open view of trailer from side at Preston Branch.

25-34 Closed view of trailer from side at Preston Branch.

25-35 View of bus by trailer at the Ledges.

25-36 View of bus by trailer at the Ledges.

PROJECT ECO - Ames Community Schools
120 S. Kellogg
Ames, Iowa

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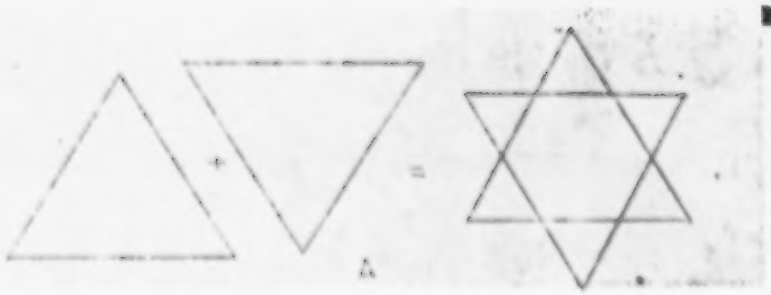
Basic Forms and Variations

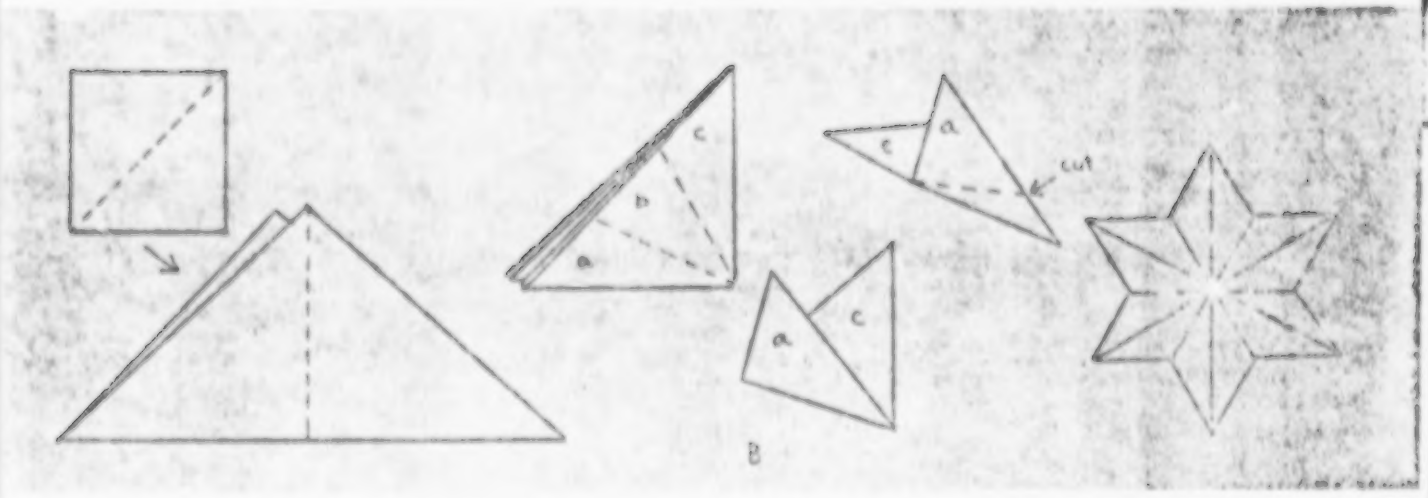
by Pauline Johnson
University of Washington Press



A

CUTTING A SIX-POINTED STAR

Fold a square in half from corner to corner, then fold in half again. Divide space into thirds. Fold one third upward (a over *b*). Fold c under. Cut on dotted line. Overlapping two equilateral triangles will also form a six-pointed star. A three-dimensional effect can be achieved by cutting on the dotted line shown in diagram C and lapping point *a* over point *b*. The star can be creased across the points (diagram D) or scored through the points (diagram F). The center can be cut out (diagram E) and a candle inserted. Stars can be used for the top of the Christmas tree, on packages, for mobiles, and for ceiling decorations.



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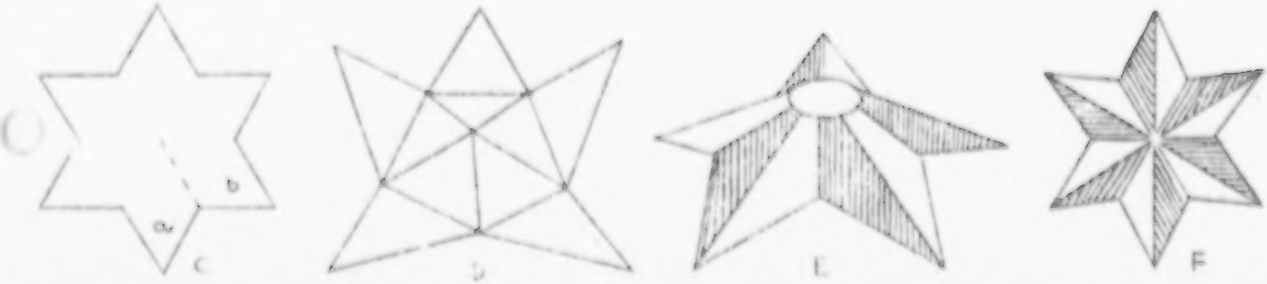


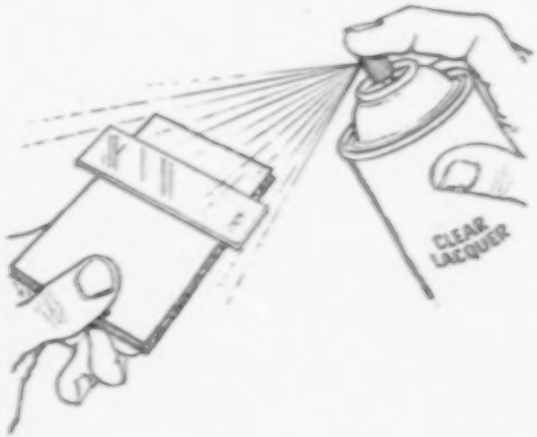
C D E F

SNOW STUMPE. by David Webster

Looking at Snowflakes

American Museum of Natural History
The Natural History Press
Garden City, New York 1968

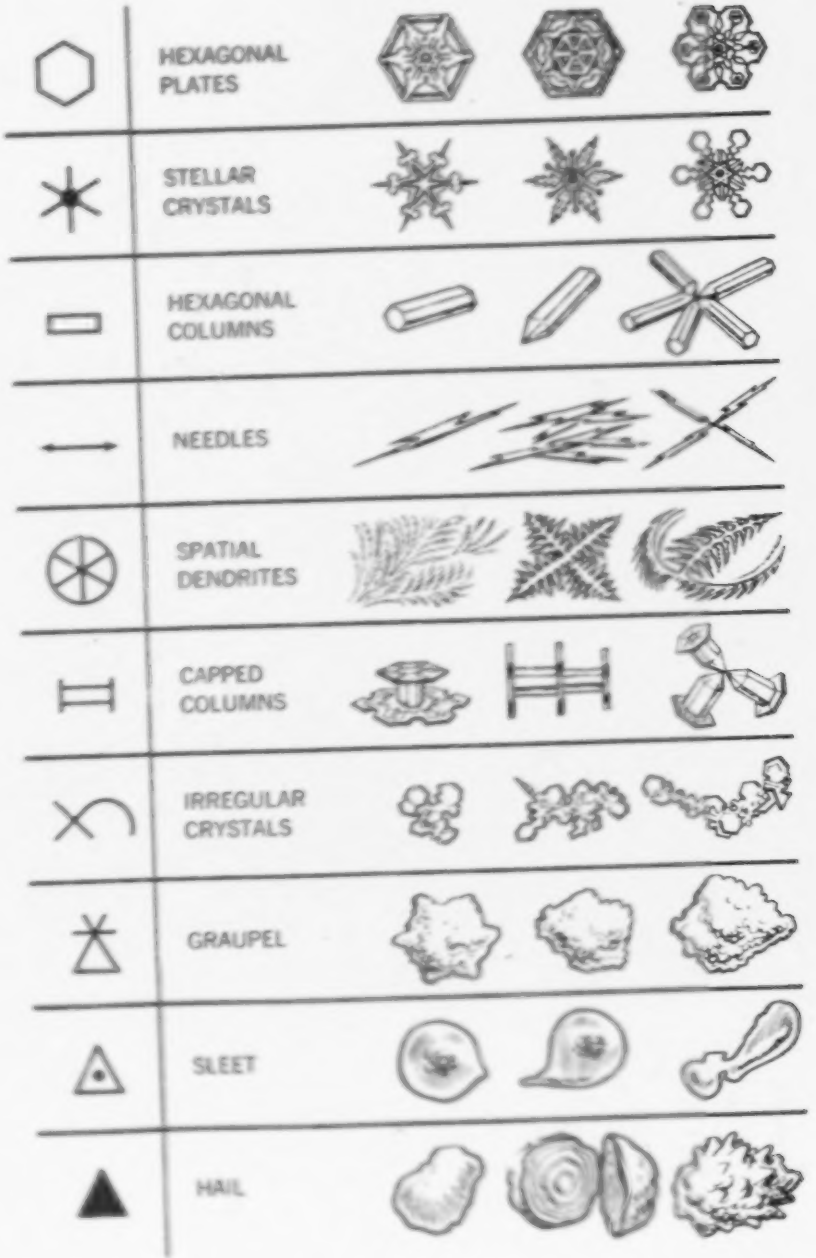
You can preserve snowflakes by using a clear lacquer spray and then examine them under a microscope.

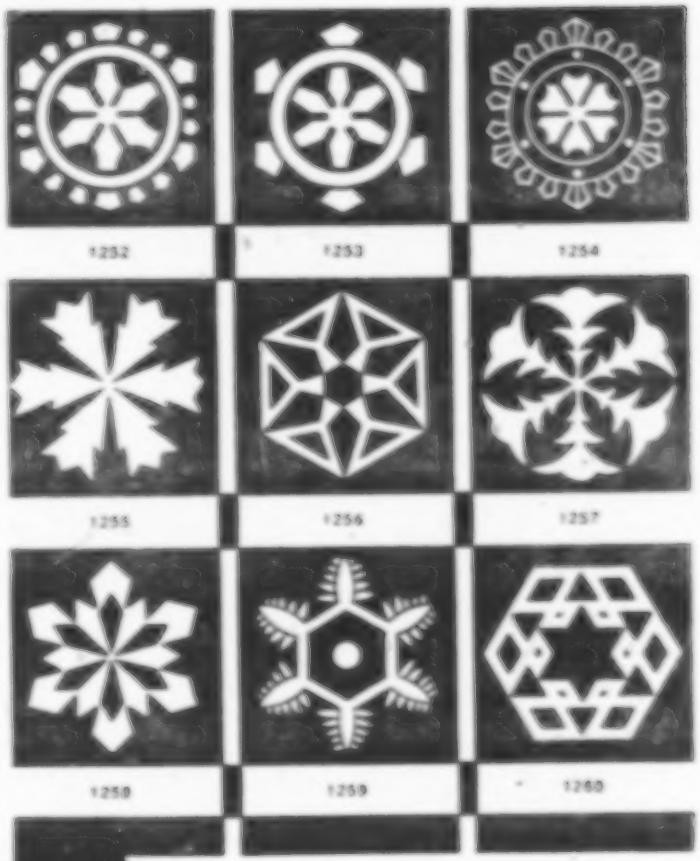


Here is the procedure to follow:

1. Obtain some microscope slides and a can of Krylon clear lacquer (it comes in a spray can).
2. Store the slides and lacquer in the freezing compartment of your refrigerator.
3. When it is snowing, take the slides and spray from the freezer and quickly put them outside so they do not warm up.
4. Hold a slide on a piece of cardboard or wood so the heat from your hand does not make the slide warm.
5. Spray a thin coat of Krylon clear lacquer on the slide.
6. Put the slide out in the snow until a number of snowflakes have fallen on it.
7. Now place the slide someplace out of the snow but still outside the house in the cold. Let it dry here for an hour.
8. Prepare a number of slides this same way.
9. When they have dried, you can bring them in and look at their shapes with a microscope.

Snowflakes come in variety of different shapes. The chart below shows how snowflakes are classified. See how many kinds you can find.

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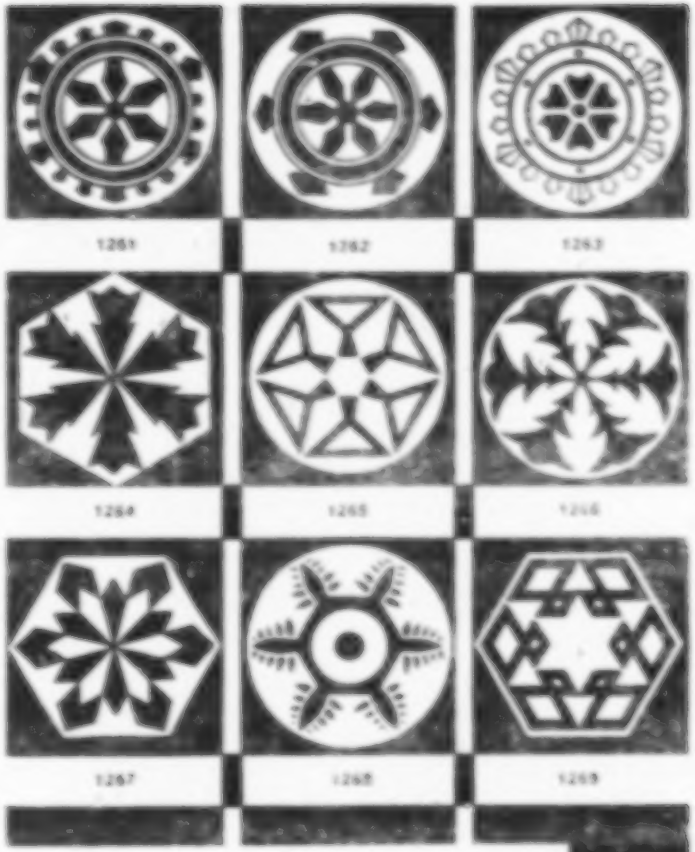
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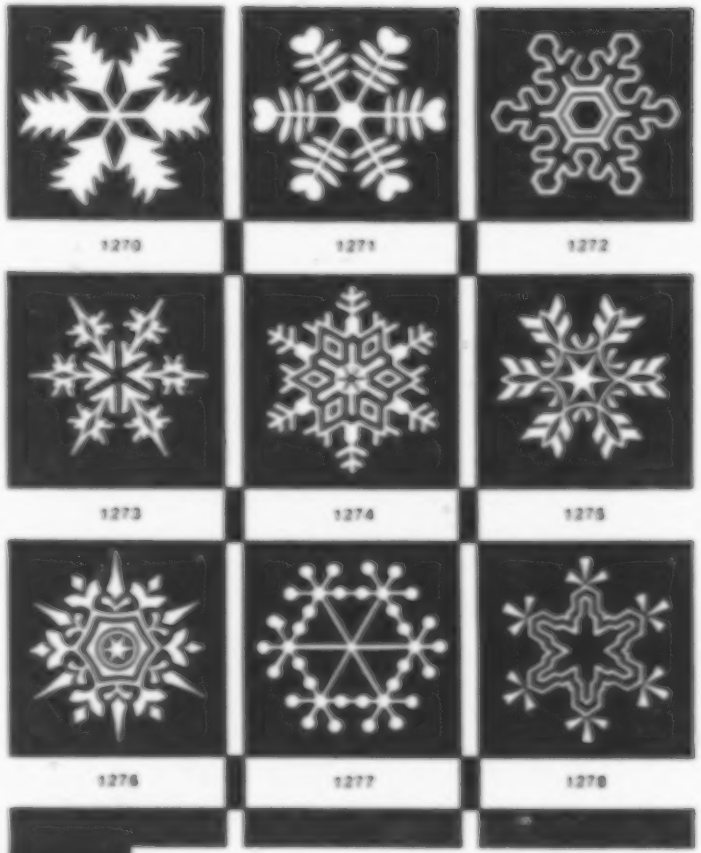

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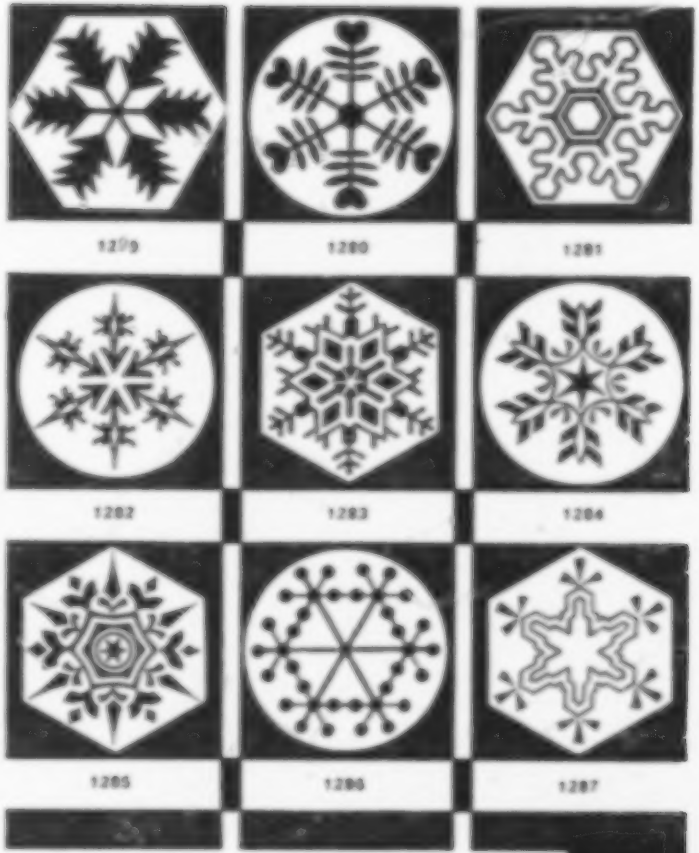

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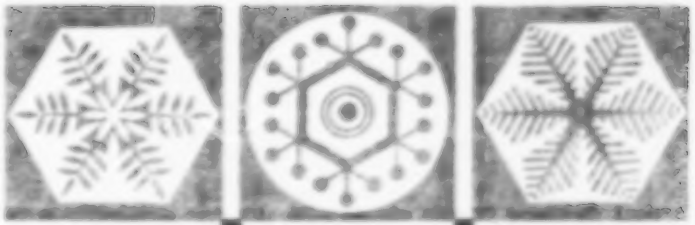

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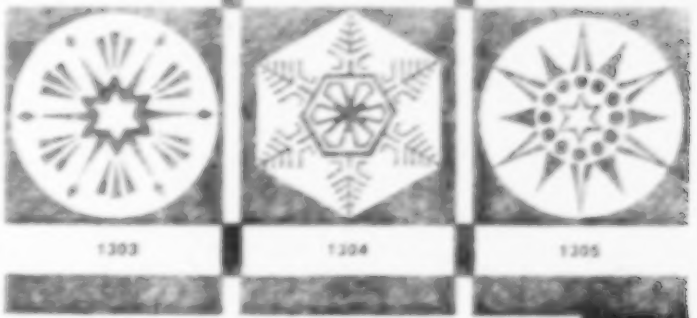

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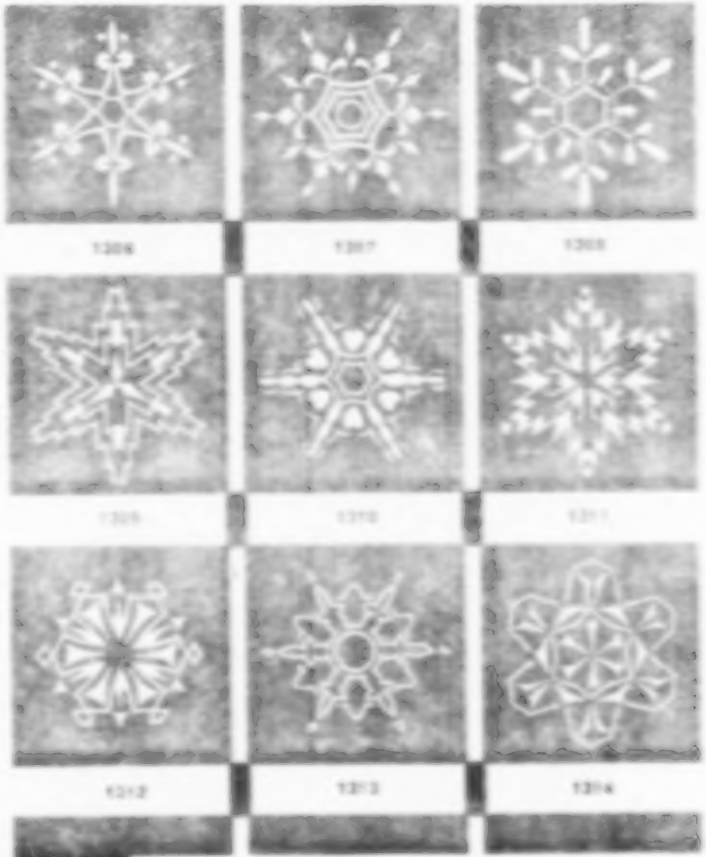
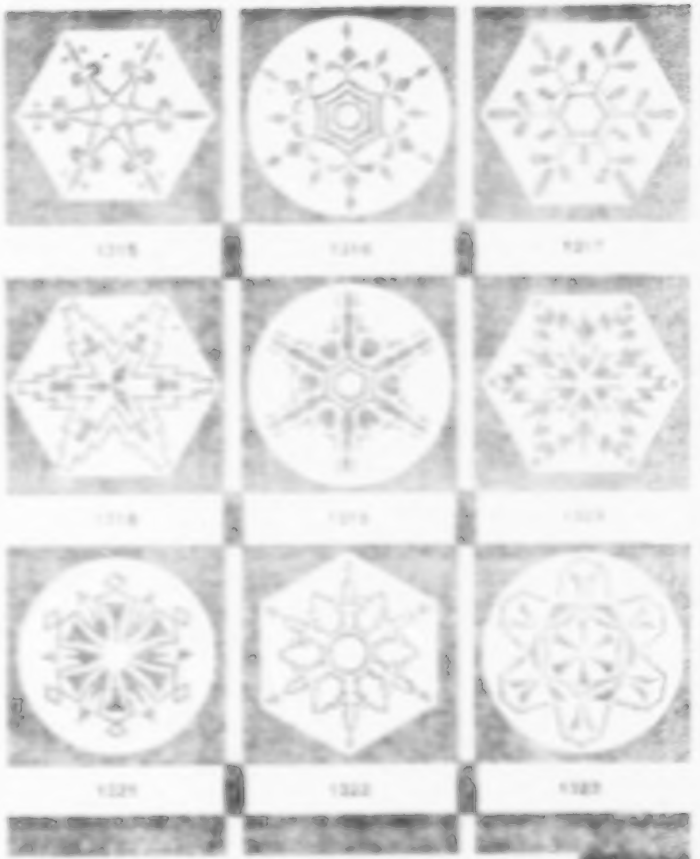




NATURE PICTURE

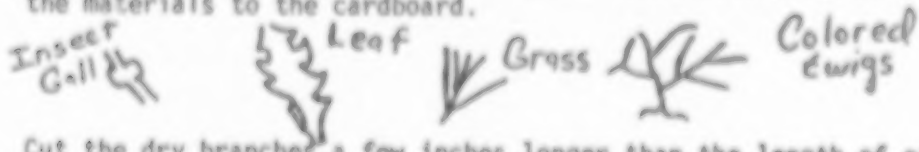
MATERIALS:

Grasses, dried
Corn, shucks, kernels
Sand
Pebbles
Twigs, various sizes and colors
Other dried materials
Cardboard
String or cordage
Glue
Poster paint, any desired color

TOOLS: Knife

DIRECTIONS:

1. Cut pieces of cardboard to the desired "picture" size.
2. Paint on it a solid background.
3. Place the materials mentioned above on the dry painted background so that they will form a picture or perhaps merely an interested arrangement. When the arrangements are satisfactory, glue the materials to the cardboard.



4. Cut the dry branches a few inches longer than the length of each side of the cardboard.
5. Lash them together to make a frame for the picture.
6. Lash, tack, or glue the cardboard to the frame.
7. Tie the ends of a piece of string to two corners of the frame so it may be hung on the wall.

VARIATIONS

1. Paint clouds, sky and lakes and then fill in trees, building, path, and rocks by gluing dried nature materials on this painted background.
2. If you have a cardboard box a 3-D type of picture can be made much in the same way as in (1) above.

*Northern Illinois University

SOCIAL STUDIES ACTIVITIES

Make maps and models of the areas; camp or other outdoor areas.
Dramatize various aspects of life among pioneers, Indians, etc.
Determine how and why a pioneer family would choose a particular location for a home site.
Examine an old home site, make a sketch of how you think it might have looked when it was occupied.
Obtain and use old tools -- note changes toward "modernization."
Learn how to use flint and steel, bow and drill, etc. to build a fire.
Find out how the phrase "to light a shuck" originated.
Explore an older cemetery to discover local history recorded on the stones.
Obtain some wheat, oats, or barley. Use some clean, dry, smooth rocks to grind the seeds into flour. Use your flour to make bread, pancakes, etc.
Read about, organize and play some Indian games.
Look for the various ways man has changed the environment of the area.
Have an old timer come to visit and tell about the "early days" and write about what he tells.
Visit the many spots of local historical interest.
"Interview" some older people in the area about the history and development of this locality.
Learn about and act out an Indian ceremonial.
Learn the proper use of a compass.
Do tombstone rubbings.
Use a compass to map the area.
Study and map a drainage pattern.
Discuss the influence of environment on people's way of life.

ART ACTIVITIES

Make transfer, block prints, or crayon prints.
Build and fly a kite.
Make some natural dyes from various berries, stems, barks, leaves and roots. Use these dyes on cloth, paper, etc.
What color combinations can I find in nature that would make a good color scheme for a design?
Make a seed or pebble mosaic.
Make table decorations or centerpieces from natural materials.
Make leaf prints.
Sketch with charcoal from your own fire.
Make jewelry from polished wood.
Use mud or natural clay to make simple puppet heads representing woodland creatures.
Make on-the-spot sketches to be used later.
Use nature to discover shape and form.
Try to make a comparison of nature colors with 'man-made' colors.
Use a small cardboard form to frame an area to be sketched from a distance and the same frame to sketch a part of the same area when closer.
Draw clouds and cloud changes using chalk and colored paper.
Sketch patterns of insect movement.
Sketch erosion patterns.
Make nature cartoons about animals ("Super Smokey and His Friends")
Build up a store of natural materials for art and craft work.
Make prints by grinding and sifting various rocks and clays and mixing with mucilage, lanolin or face cream.
Experiment with charcoal produced by burning different kinds of wood.
Use natural clay for modeling.
Use natural materials to make mobiles.
Use mushrooms to make spore prints.
Make a sand picture or print.
Prepare an insect "log" or "Insect Hall of Fame."
Make place cards for leaves.
Collect unusual pebbles and treat with equal parts; white shellac and wood alcohol to bring out colors.
Make animals, etc., from twigs.
Prepare plasters casts from animal tracks.
Braid cornhusks into mats or figures.
Do snow sculpture or modeling.
Prepare a spider web print using white paint (spray type) and a dark paper background.
Gather leaves, grass, and seeds of different shapes and colors. Place between two sheets of wax paper and press gently with a warm iron.

LANGUAGE ARTS ACTIVITIES

Play "blind" and describe various outdoor situations.
Write a letter home or to a friend.
Take field notes.
Use the camp library for research and reading.
Tell some original "tall tales".
Write a story or a song about the out-of-doors.
Plan and prepare a tape of your outdoor experiences.
Write a poem about the Mississippi.
Take a camera hike.
Keep an outdoor diary or "log".
Practice careful listening.
Recognize and record new "outdoor words."
Write new words in snow, sand, or moist earth.
Enrich word meanings.
Make temporary or permanent labels for a nature trail.
Use children for "living labels".
Make a trail guide.
Produce one-sentence descriptions.
Describe a natural phenomena such as a storm.
Write stories or poems about natural objects.
Give news or weather reports.
Compose a myth or legend about some area or object.
Identify and label specimens.
Keep a diary or write a story about "My Spot" (an outdoor area chosen by the student of particular interest to him)
"Space Traveler" --- describe our environment from an outsiders point of view.
Take some good "nature notes."
Describe various outdoor odors using proper terminology.
Learn to spell the names of trees, animals, etc.
Talk with "oldtimers" to learn the history of trees.
Start a tree calendar and diary.
Make a list of "outdoor" sounds and weave them into a story.
List several adjectives such as soft, smooth, twisted, and hunt for nature objects to fit these words.
Describe nature sounds in writing.
Compose outdoor rope-skipping rhymes.
Write a story about "stars".
Compose a "ballad".
Prepare a radio or television program. (make-believe)
Use charades to portray new outdoor vocabulary words.
Interview various adults about the out-of-doors game warden.
Dramatize some "problems" of the pioneers or Indians.

MATH ACTIVITIES

Scavenger hunt for geometric figures.
Temperature by cricket chirps - Count the number of chirps in 15 seconds and add 40 to determine the temperature in degrees (f).
Compare the six basic shapes of snowflakes.
Estimate the amount of water needed for each individual per week at camp, school or home.
How big is an acre - the amount of prairie land that a pioneer could plow in one morning?
Working as a group, gather one million acorns, small rocks, etc. This activity makes the concept of "one million" much easier to grasp.
Measure and compare size, shapes and weights of various leaves.
Lay out areas - study perimeters - find square feet.
Make a line graph of comparative temperatures for a week.
Observing mathematics in leaf formation.
Use leaves to show the meaning of numerals.
Compare centigrade (celsius) and fahrenheit temperatures.
Use "personal" standards of measure such as length of pace, hand span, length of arm, etc.
Make and use a clinometer.
Estimate weights and lengths of objects.
Learn about standards of weight and length. Establish some of your own standards using stones and sticks.
Make a sundial.
Estimate the passage of time, short and long periods.
Estimate tree heights.
Take a "tree census".
Estimate distance by pacing.
Count, tally, and average in the outdoors.
Calculate topsoil losses after heavy rains.
Discover how fast water flows in small creeks and rivers.
Study the travel rate of various insects in feet per second or inches per minute.

ALPHABET OBSERVATION HIKE

PURPOSE: To help the individual become aware of native materials found in the outdoors through direct observations.

PROCEDURE: Divide into small groups and have each group list as many natural items they can find beginning with each letter of the alphabet.

DESCRIPTIVE WRITING

DIRECTIONS: Find the objects listed below and then do the following things with each object: (1) look at the object
(2) feel the object
(3) smell the object
(4) listen for sounds which may come from it or are associated with it
(5) taste it (if safe to do so)

Write as many descriptive words as the basis for description as you can using your sensory experiences
Some possible examples are:

1. This year's deciduous leaf
2. This year's evergreen leaf
3. Last year's deciduous leaf
4. River water
5. Water from the stream
6. Wet soil along the river
7. A rock
8. Twig on a tree
9. A flower
10. Bark on a tree

*Northern Illinois University

WORDS INTO PICTURES

In my fifth grade class we are trying to become more exact in expressing our ideas. To help in this effort, I asked each student to write a descriptive paper on an imaginary animal. Then, without warning, I had them exchange papers. Next, I asked each child to draw a picture of the description he received.
Their enthusiasm was high, their reactions natural and critical: 'Nothing here tells me how big it's suppose to be.' 'I can't make him do anything because that was left out.'
After several attempts at this activity, the student's descriptions, and thereafter their pictures, became much more detailed.

*Shirley R. Secord, fifth grade teacher
Central School, Natick, Mass.

SCIENCE ACTIVITIES

Mark and release some insects for an ecological population study.
Does snow actually form a warming blanket over our earth?
Use thermometers to find and answer this.
Give daily weather reports at school or camp.
Make a comparison of temperatures in sun and shade, on bare ground, in water, grass, etc.
Visit a conservation area.
Visit a farm where conservation activities and practices are being followed.
Examine and identify tracks.
Investigate plant growth, recovery and grafting techniques.
Prepare a leaf or wood specimen collection.
Make a seed collection. Classify the seed according to the way they travel or are carried.
Count the number of seeds on a plant;average counts of ten or more plants.
Conduct experiments to see what kinds of foods, birds, fish, squirrels, etc.
Observe plant succession.
Experiment with various types of weed killer.
Exchange or replant sod, shrubs, and small trees into a new environment. Observe and record results.
Research and find in nature the Iowa State flower, bird, tree, rock, etc.
Dismantle several abandoned birds' nests and try to determine what building materials were used.
Make a bird survey. Observe bird feathers with a hand lens or microscope.
Go on a bird hike early in the morning with some members of the Audubon Society.
Tap a maple tree, collect the sap and boil it down into maple syrup.
Build a bird feeder or bird house.
Make a "Light trap" for collecting insects.
Build an observation beehive or antnest.
Collect and study insect galls.
Build and use a small animal trap to catch mice, shrews, etc.
Prepare a collection of various soils.
Make simple rock groupings according to weight, color, shape, etc.
Do an experiment to show relationship between snow volume and water volume after the snow has been melted.
Devise some instruments to measure rainfall, wind, velocity and direction.

PROJECT ECO

SPECIAL FIELD TRIPS

Project ECO

AMES COMMUNITY
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120 S. Kellogg
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SPECIAL FIELD TRIP NO. 1
The Iowa Historical Museum -- located at East 12th and Grand, Des Moines, Iowa -- As a Supplement to Environmental Education Sponsored by Project ECO

The display of early modes of transportation located in the basement room of the museum lends itself to the study of pollution by modern modes of transportation. If one would discuss the hardships endured by the early emigrants and convince the students that they must make value judgements as to the good the modern cars serve as opposed to the harmful aspects of pollution.

A comparison should be made as to the structure of the wagons, the purpose they served, the relative speed and comfort of travel, etc. I think the Milburn Electric should be emphasized so that students could see that the idea of an electric car is not something entirely new.

The mounted animal display on the second floor is a must. It should be pointed out that the animals are not killed to be prepared for the wildlife displays but are salvaged after death has resulted from various accidental means. This display includes some passenger pigeons which gives an opportunity to discuss other species that are in danger of extinction.

The display of Indian culture on the third floor is valuable in showing how closely some people have to adjust to the land in order for them to survive. It also serves to give the student a deeper appreciation of their role in the total environment.

The rock and fossil displays, also located on the third floor, can be utilized as a motivator to help the student become aware of his surroundings and become more inquisitive about his region.

IOWA STATE HISTORICAL MUSEUM DISPLAYS

VEHICLES (not numbered at museum)

1. Family Ox Wagon - Used by John T. Ames to move to Iowa in 1854. He settled in Tama County. 15 miles per day was considered excellent time, compared to 500 miles per day now. Donor - John T. Ames, Jr.

2. Stage Coach - Used in Iowa in the 1850's. Rapid transit - 40 or 50 miles per day. Notice leather strap and rocker suspension instead of springs. Also called a "two horse jerky". Served in Afton and Red Oak area. Donor - Mrs. Perry Tracy, Red Oak, Iowa.

3. Rockaway Carriage - Built in 1841. This style remained popular many years. Ad in newspaper in 1875 lists one for $35. However, with wages about 10¢ an hour money was scarce. Donor - Ira B. Overbolt, Harlan, Iowa.

4. Conestoga Wagon - The name is Iroquois: Called Conestoga from vicinity in which they were first in common use, viz. Conestoga Creek, Lanchester Co., Pennsylvania. Also known as Pennsylvania Wagon, Quaker Wagon, and in the middle and western states it was called the Prairie Schooner.

   First appearance in 1775, when Franklin advertised for 150 of them for use of General Braddock's Army. Also they were furnished to the Continental Army in the War of the Revolution, mainly supplied from Pennsylvania. During the War of 1812, the wagons transported arms, ammunition and supplies to army on frontier. They were also in constant use in peace; their numbers were vast. At one time, over 3000 ran back and forward between Philadelphia and other Pennsylvania towns, sometimes 100 would follow in close row. They were conspicuous in the winter seasons while competitors (the canals) were frozen. From middle colonies, this wagon found its way to every colony and every settlement. Renamed "prairie schooner" it carried civilization and emigration across the continent to the Golden Gate. The bleaching bones of these wagons may still be seen in our far west, and are distinct relics of the old pioneer western life as are the bones of the buffalo.

   These wagons were later cast aside in barn yards near El Reno, Oklahoma where in 1904 an agent for the "Seminole Indian Medicine Co." (Montgomery Brothers Proprietors) of Boone, Iowa found them. They were used for the "Texas Bill Wild West Shows" for a few years then in 1908 were presented to the museum.

5. Brougham Carriage - 1868. Town carriage used by James D. Edmundson, Pioneer Lawyer - Banker and Philanthropist. The Des Moines Art Center was founded as a result of one of his generous gifts. Donor - J. D. Edmundson, Des Moines, Iowa.

6. Cadillac - 1905. Single cyclinder, 7-1/2 HP. Water cooled, planetary transmission (a form of transmission for varying the speed transmitted from the engine). Price $750. Founded late in 1902. Only three (3) 1902 cars built. In 1906 Cadillac outsold both Ford and Olds in the "low market" field. GM took charge in 1909 and Cadillac moved into luxury market. Donor - D. S. Kruidenier, Des Moines, Iowa.

VEHICLES (continued)

7. Milburn Electric - Used by Governor George W. Clarke from 1919-1940.

8. Mail Wagon - Owned and used by Rex T. Taylor (1897-1971) of New Virginia, Iowa. Mr. Taylor carried mail in that area of Warren Co. for 38 years; he retired in 1962. When he started in 1924, Rural Route 2 was 26 miles of Iowa mud, and he had 136 patrons. 38 years, 8 horses and 13 fords later his route was 66 miles and he had 151 patrons. Purchased in 1924 for $127. Annual salary was $1,800 in 1924. Donors - Mrs. Zona Cole Spokane, Washington; Mrs. Sharon Boatwright, Delano, Minnesota; and Mrs. Kay Johnson, Scottsbluff, Nebraska.

9. Locomobile - 1897. One of the first cars in Iowa. Had 2 cylinder, steam powered, tiller steering (Locomobile was steered with a bar rather than a steering wheel) and chain drive. Owned and operated by W. G. Haskell, Cedar Rapids, Iowa. Donor - Guy Haskell.

10. Knoxmobile - 1901. Show car at first auto show in Chicago. It was bought by W. H. Steer of Madison Co. One cyclinder, gasoline engine and chain drive. Unique springs. Cost $850.

11. Sleigh - Used by F. M. Hubbell, Des Moines, Iowa.

AIRPLANES

Bleriot XI (2nd Floor) - 1909. Result of 10 previously unsuccessful planes built in France by Louis Bleriot. This one was very successful -- established many firsts and set pace in airplane development. Modern aircraft still quite similar.

Bleriot XI firsts -- fly English Channel
fly Alps
have modern controls
loop the loop
fly the mail
fly in Des Moines
be mass produced

Data about Bleriot XI

Weight			600 lbs.
Length			26 ft. 5 in.
Wingspan			30 ft. 5 in.
Takeoff and landing speed			25 MPH
Performance			
35 MPH	26 HP	Anzanni	
40 MPH	50 HP	7 cyl.	Gnome
80 MPH	100 HP	9 cyl.	Gnome

Note of Interest: Louis Bleriot made the first international airplane flight. In 1909, he flew 23-1/2 miles across the English Channel from France to England in 37 minutes.

AIRPLANES (continued)

Benoist 1915 (3rd Floor) - Built and flown by Oscar Solbrig at Davenport, Iowa. First airplane made in that area. Donated by his family.

STUFFED ANIMALS (Listed by displays -- displays not numbered at museum)

Display 1:
Red Tail Hawk (Male, female, two young and nest)
Harlan or Blackhawk (Male and female)
Spotted Hawk (Male)
Marsh Hawk (Female, four young, and nest)
Roughed Legged Hawk (Female)
Sparrow Hawk (Male and female)

Display 2:
Prairie Hens (or Prairie Chickens)
(Male, female and eggs)

Display 3:
2 Bald Eagles and three young
Sandhill Crane
Whistling Swan
Double Crested Cormorant
Great Blue Heron
3 Golden Eagles

Display 4:
Passenger Pigeons (Male and female) [Note: Passenger pigeons extinct.]

Display 5:
American Bison (Bull, cow, and calf)

Display 6:
Deer
Eastern Chipmunk
American Elk (Buck, cow and 2 young)
Gold Finch
Wild Turkey

Display 7:
Mongolian Pheasant (5 male and 3 female)

Note: Mongolian Pheasant are very important game birds in Iowa.

Display 8:
American White Pelican

Display 9:
Loom Family (Notice extreme rear position of feet)

Display 10:
American Moose (Bull, cow, and bull calf)

Display 11:
Raccoon (2 male and 1 female)

Display 12:
Red Fox (Male and female; Female with 11 kittens)

Display 13:
Black Bear (brown) female
Black Bear (Male)
2 Black Bear Cubs
Black Bear (Male)
Albino Squirrel
Northern Skunk (Male, female and 2 kittens)
Albino Skunk

(A good chance to talk about heredity mistakes.)

STUFFED ANIMALS (continued)

Display 14: Ruffed Grouse (4 male)
Wood Cock (Male, female, nest with 4 eggs, and nest with 2 new hatched chicks)
Bob White (1 male and 2 female)
European Partridge (3 male, 6 female and next with 16 eggs)

Display 15: Iowa Brush Wolf (1 female and 5 cubs) [Notice them feeding on lamb]
Coyote Cub

Display 16: Whistling Swan (Male and female)
Canada Goose (Male and female)
Brant Goose (Male and female)

Display 17: Screech Owl (1 male and 3 female)
Barred Owl (Male, female and 2 eggs, and 2 young)
Barn Owl (Male and female)
Long Eared Owl (Male and female)
Great Horned Owl (Male and female)
Snowy Owl (Female)
Great Gray Owl (Male)
Richardson's Owl (Male)

Display 18: Ducks of Iowa
Mallard (Male and female)
Black Duck (Male and female)
Hooded Merganser (Male and female)
Green Winged Teal (Male and female)
Wood Duck (Male and female)
Blue Winged Teal (Male and female)
Buffle Head (Male and female)
Scaup Duck (Male and female)
Ringneck Duck (Male and female)

Display 19: Spring Migration of Shore Birds
Forster's Tern
Marbled Godwit
Stilt Sandpiper
Hussonian Godwit
Sanderling
Lesser Yellowlegs
Wilson's Phalarope (Male and female)

Display 20: Numerous Song Birds

INDIAN DISPLAYS

Wickiup -- Traditional house of the Woodland Indians. Bark slabs were sometimes used instead of mats. This one was built by the people that live at Tama.

Corn grinder or matate (met-tah-tay) - Many Indians used a flat stone for grinding corn and some preferred one made of wood.

Birchbark Canoe -- 1917 -- Chippewa
Dugout Canoe
Birchbark Canoe -- 1908 -- Made in Ely, Minn.

Pottery -- Offer students a chance to see different styles of pottery made from clay.

Pueblo Pottery - Zuni, New Mexico
Caddean Pottery - South Central United States
Ceneota Pottery - Allamakee County, Iowa

Many Indian Displays such as:
- Human bones and skulls
- Stones used to make tools and weapons, etc.
- Indian weapons
- Indian weaving and beadwork
- Indian clothing and headdress
- Bones and skulls of different animals (bison, etc.)

Excavation from West Des Moines -- Mississippian culture from 250-400 years ago.

Remains include:
- flexed burial* of an adult and infant
- remains of two juveniles
- flexed burial of a male

* an ancient form of burial in which the knees of the corpse are drawn up to its chin to make the body more compact.

Artifacts from excavation include:
- Chert knives
- Potsherds
- Rubbing stone
- Scrappers
- Red ochre
- Celt
- Beads made from sea shells
- Chert flakes
- Shell remains
- Rodent teeth
- Shell crosses
- Animal remains
- Objects made from sea shell
- Crosses made from clam shell
- Shell cross fragments

OTHER DISPLAYS OF INTEREST

Basement

1. Flour mill -- First set up on Iowa River in 1877. Moved to Skunk River near Colfax in 1888. Powered by water. In 1901 it was moved to Rooker Farm near Mitchellville and converted to steam power. Note wooden teeth on drive gear. Donor - S. T. Rooker.

2. Block from Log of Fir Tree, Chehalis, Washington -- 267 "annual" rings in section cut in 1893 which indicates tree was a seedling in about 1626, six years after Pilgrims landed at Plymouth Rock.

3. Collection of early bicycles (direct drive, chain drive, gear drive).

4. Collection of early farm tools and equipment.

5. Sheep power treadmill.

6. Keystone corn planter, 1870, entirely manual operation.

7. Collection of large animal traps used by pioneers.

1st Floor

8. Rifle and sword collection.

9. Collection of early glassware including: Early American Glass, Cut and Engraved Glass, Pressed Glass, and Bottles.

10. Library.

2nd Floor

11. Collection of early home furnishings.

12. Collection of early toys, books and dolls.

13. Collection of early and present telephones.

14. Collection of lights in early history.

15. Collection of early medical equipment.

16. War relics of the Spanish American War.

3rd Floor

17. War relics of the Civil War, including a Gatling Gun.

18. War relics of World War II, including uniforms and medals, etc.

19. Collection of early Iowa pottery and Pewter Ware.

OTHER DISPLAYS OF INTEREST (continued)

3rd Floor

20. Many specimens of rocks, minerals and petrified wood.
21. Display of Geodes of Lower Warsaw Formation (State Rock of Iowa).
22. Display of Stalactites and Stalagmites.
23. Display of fossils of LeGrand, Iowa (world wide index fossils).
24. Display of Crinoids.
25. Display of fossil leaves of Iowa.
26. Plant fossils.
27. Crystals from Iowa mines.
28. Display of Fluorescent Minerals.
29. Display of Sea Coral.

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SPECIAL FIELD TRIP NO. 2

The Des Moines Center of Science and Industry -- located at Greenwood-Ashworth Park, Des Moines, Iowa -- As a Supplement to Environmental Education Sponsored by Project ECO

The Des Moines Center of Science and Industry has two permanent displays and a planetarium that could easily be correlated with studies concerning the environment.

Upon entering the building one is greeted by a Foucault Pendulum that swings back and forth knocking over progressive pegs at the rate of one every 3-1/2 minutes. The Foucault Pendulum was designed by Jean Foucault in 1851 and is used to prove, mathematically, that the earth rotates on its axis. This rotation must be understood before one can grasp the underlying principles relating to wind and ocean currents and the directional aspects of these currents. At this time one might point out that the early astronomers believed the earth was the center of the universe and the planets and stars all revolved around the earth (Ptolmey's Theory). This could be compared to the theory that forms the basis for our modern beliefs concerning the movements of our celestial bodies (Copernican Theory).

The second permanent display is located in the basement area and concerns energy -- some forms, usage and conversion techniques. This is a commercially prepared exhibit and has panels depicting some of the famous scientists that have made major contributions to the study of energy conversion, backlighted assemblages illustrating conversion machinery and listening stations that play back information concerning various components of the display. Midway through this exhibit there is a stationary bicycle that has the rear wheel connected to a generator. As the student pedals the bicycle generator is activated and, provided the wheel turns fast enough, the electricity generated will light a portion of the exhibit. This enables the student to experience the energy conversion. The last station of this exhibit is a slide presentation, with audio narration, that illustrates some of the environmental problems that result from air and water pollution.

The planetarium can be rented for special showings if reservations are secured at an early date. These showings can accomodate up to 75 persons and cost $25.00 per showing. The planetarium is open to the public, at a nominal fee, on Tuesday and Friday evenings as well as Saturday and Sunday afternoons and evenings. Further information about planetarium showings should be secured from the business office, Greenwood-Ashworth Park, and the telephone number is 274-4138.

Other exhibits include youth projects illustrating science principles, phono vision, a collection of early typewriters and several temporary displays of interest. Approximately 90 min. should be allowed to properly view the exhibits.

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SPECIAL FIELD TRIP NO. 3

The Anderson-Erickson Dairy -- located at 2229 Hubbell Avenue, Des Moines, Iowa -- As a Supplement to Environmental Education Sponsored by Project ECO

This trip should be arranged through the business office of the dairy and the telephone number is 265-2521.

The tour through the plant includes an explanation of milk pickup from the farm and delivery to the dairy. Methods of transfer, sterilization, and initial storage are explained in detail, depending on the grade level of the group. The processing of the milk is continued and as the tour progresses they are able to view the production of cottage cheese, bottle cleaning, homogenizing and pasteurization methods and the steps taken to test the quality and purity of the finished product.

The tour concludes with each student receiving a carton of chocolate milk and an explanation of bacteria control and the care taken to insure a product fit for human consumption.